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Ergebnisse der Österreichischen Neukaledonien-Expedition: The Blepharoceridae (Diptera) of New Caledonia

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SYNOPSIS

Blepharoceridae are reported for the first time from the island of New Caledonia. Three new species—*kaltenbachi, microcephala* and *starmuhlneri*—are described in *Austrocurupira* Dumbleton, a taxon originally designated a subgenus of *Neocurupira* Lamb and now elevated to generic status. A new subgenus, *Curupirina*, is erected for these three species. A fourth new species, the type of a new genus, is named *Nesocurupira curtirostris*; it is remarkable for the extreme reduction of its mouthparts. These four species belong in the Apistomyinae. A fifth species is represented by a single larva very different from those of the other species; its affinities cannot be ascertained, but it may belong to the Paltostominae.

The relationships of the New Caledonia blepharocerids reflect the position and isolation of the island. The distinctive *kaltenbachi* group of species is related to *Austrocurupira nicholsoni* (Tillyard) of Australia, and the strongly apomorph *Nesocurupira curtirostris* may be related to *Nothohoraia* Craig of New Zealand.

INTRODUCTION

A view widely held concerning the distribution of the Blepharoceridae is expressed in the following often-quoted statement by Tillyard (1922: 161): 'In all stages of their life history, Blepharoceridae are dependent on the rushing water and spray of waterfalls, and are quite unable to exist for more than a very short time without these. Hence their distribution cannot have been brought about by sea or air carriage, but must have taken place along definite land routes marked by the frequent occurrence of running streams; and this of course, indicates land of a mountainous nature.' Because of these special ecological requirements and consequent limited possibilities for dispersal, the presence of the family on islands has always aroused great interest. Edwards (1929: 33) points out that Tillyard's statement needs qualification in view of the occurrence of a species, *Paltostoma schineri* Williston, on the islands of Trinidad and St Vincent which, as Scott (1915: 197) remarks, are of different origins, the former being a continental island, a detached fragment of South America, whereas the latter is an oceanic island of volcanic origin, presumably never with dry-land connections to other land masses and therefore populated by immigrants arriving over the sea. The checklist of blepharocerid species given by Alexander (1958) shows that St Vincent still is the only oceanic island known to have a member of the family. All other islands on which Blepharoceridae occur—Trinidad, Corsica, Sardinia (Zwick, 1968), Ceylon, Formosa, Japan, Borneo, Mindanao, Java, New Zealand, Tasmania and Madagascar—are islands with rocks of continental types and nearly all of them are known

to be recently (in the Plio-Pleistocene) detached portions of neighbouring continents, or parts of youthful fringing archipelagos (Darlington, 1957: chap. 8; Carlquist, 1965: chap. 2). Exceptions are New Zealand, which probably has been isolated since the late Cretaceous (Fleming, 1962), and Madagascar, which has been an island since the late Jurassic (Dixey, 1955). Taxonomic relationships accord with geomorphological history, and the islands recently formed have blepharocerids differing from those of adjoining continents only at the species level, an exception being Ceylon with its endemic genus *Hammatorrhina* Loew. The older islands have distinctive endemic genera: New Zealand has *Neocurupira* Lamb, *Peritheates* Lamb and **Nothohoraia* Craig, and Madagascar has *Paulianina* Alexander, a remarkable genus comprising with *Edwardsina* Alexander the most primitive of the four subfamilies.

The blepharocerid fauna of the Australasian Region, which is essentially a number of islands very different in size and degree of isolation from one another, is especially interesting. In Australia the family has received little attention since the pioneer studies by Tillyard (1922) and Tonnoir (1923*a*, *b*, 1924), but the New Zealand fauna has been reviewed recently by Dumbleton (1963*a*, *b*) and is the subject of an extensive monograph by Craig (1969). New Zealand has the three endemic genera mentioned above, with a total of seven species, all of which fall in the Apistomyinae. Australia has a species of the otherwise New Zealand genus *Neocurupira*, for which a subgenus *Austrocurupira* was erected by Dumbleton, two species of *Apistomyia* Bigot (a genus otherwise occurring in Java, the Himalayas, Formosa, Japan and Corsica), and eight species of *Edwardsina* (six in Tasmania), an often-cited 'antarctic' element otherwise found in temperate South America. Thus, two of the four subfamilies are represented, Apistomyinae and Edwardsininae.

Previous workers on these blepharocerids have noted the almost complete lack of genera common to New Zealand and Australia; the only one recorded on both sides of the Tasman Sea is *Neocurupira*, but even this is a link of problematic significance as the Australian species is segregated in its own subgenus and doubt has been expressed by both Dumbleton and Craig as to its relationships. It appears therefore that opportunities for colonisation of these islands have not been equal, and must have been affected by their differing geomorphological and perhaps climatic histories. The same contrast is shown by some other rheophil insect groups of cold mountain streams. Ross (1956, 1967) points out that some old genera of Trichoptera apparently reached both Australia and New Zealand long ago, probably in the Cretaceous, and have been isolated in New Zealand ever since but in Australia were subsequently joined by more recent genera immigrating from the north, probably in the Miocene. He correlates these events with the geological history of the Inner Melanesian Arc, an elongate geosyncline which might have provided land connections along its margin from New Guinea to New Zealand through New Caledonia during part of the Cretaceous. Ross considers that the New Caledonia caddis flies provide sound evidence on this point, and cites as an example a species of *Hydropsyche* occurring there which is closely related to a peculiar group of primitive species confined to New Zealand. From these considerations it would appear that New Caledonia might have an

* At the time of preparation of this paper Craig's description of *Nothohoraia* was still unpublished. As reference to the genus is essential in several places, I have used the genus name but deliberately avoided mention of the name of the type species, thus ensuring that the name *Nothohoraia* is not made valid and available by its publication here (*Internat. Code Zool. Nomen.*, art 13(*b*), 1961).

unusually interesting and significant blepharocerid fauna, but up till now the family has not been recorded from the island.

The geomorphological and biogeographical features of New Caledonia are quite well known. This is a geographically isolated, geologically complex, ecologically diverse, mountainous, mineraliferous, ancient, large island, probably subject to periods of violent vulcanicity until recent times. In its flora is an abundance of conifers, podocarps, peculiar angiosperms belonging to Winteraceae and Cunoniaceae, endemic palms, and taxonomic relicts such as *Amborella*, *Strasburgeria*, and *Nothofagus* species of the *brassi* group. In the words of Thorne (1963: 326), 'Probably no richer nor more peculiar, archaic, and endemic relict seed-plant flora can be found elsewhere compressed into such a small area.' By contrast, indigenous land mammals, amphibians, land snakes, primary fresh-water fishes and fresh-water mussels are unknown, though there is a small but distinctive bird fauna and some bats; such a paucity of non-flying vertebrates apparently denies the possibility of post-Mesozoic land connections to any continent (Thorne, op. cit.; Darlington, 1957: 525).

It is greatly to the credit of Dr F. Stärmuhlner and Dr A. Kaltenbach that they succeeded in finding, during the course of the Austrian Expedition to New Caledonia, no less than five species of Blepharoceridae. I am grateful to them for the privilege of studying their material. My thanks are due also to Dr L. J. Dumbleton who generously donated a collection of New Zealand blepharocerids, and to Dr D. A. Craig who kindly provided a typescript copy of his revision of the New Zealand species now in press. Craig's revision, cited as (1969), is based on his Ph.D. thesis, cited below as Craig (1966), a copy of which was made available to me by Professor R. L. C. Pilgrim of Canterbury University.

Holotypes and most of the remainder of the material are in the Naturhistorisches Museum, Vienna; some specimens are in the Natal Museum.

In describing the features of the head capsule and mouthparts of the larvae, I have used the terms proposed by Anthon & Lyneborg (1968).

THE NATURE AND RELATIONSHIPS OF THE NEW CALEDONIA BLEPHAROCERID FAUNA

The collection made by the Austrian Expedition contains the following five new species: a group of three closely related, allopatric, apparently recently differentiated species, described below as *kaltenbachi*, *microcephala* and *starmuhlneri*, all represented by larval instars and pupae from which one or both sexes of pharate adult have been extracted; a remarkable species described below as *curtirostris*, represented by a pharate female, two pupae and a number of larvae; and a species represented by a single larva strikingly different from the larval stages of the other four species. Before these species can be described it is necessary to determine their relationships so that their generic placement can be decided.

1. The *kaltenbachi* group. The three species of this group share the following characters: *Rs* forked, R_{2+3} therefore present; antenna 14-segmented; dichoptic, eyes with small upper division containing mostly reduced facets, no sexual dimorphism in eye structure; tibial spurs 0.0.1; mandibles absent in ♀; maxillary palps two-segmented, distal segment apically pointed; distal segment of labial palps elongate and curved outwards. The elongate, divergent apical segments of the labial palps indicate that the species belong in the sub-

family Apistomyinae. In the key to world genera provided by Alexander (1958) this group runs down to *Neocurupira*, but the key is based largely on venational characters and nothing more than the presence of a forked radial-sector is used to differentiate *Neocurupira* from the other apistomyine genera. In Dumbleton's (1963*a*: 251) key to the Australian blepharocerid genera, the *kaltenbachi* group falls in *Neocurupira* on account of the forked *Rs*, and in the subgenus *Austrocurupira* created in the key by Dumbleton for the single Australian species described in *Neocurupira*, viz. *nicholsoni* Tillyard (1922). The subgenera are differentiated by Dumbleton as follows:

> 'Second segment of antenna not twice as long as third; distal segment of maxillary palp short, apically rounded or subtruncate; hind legs not markedly stouter; outer lamellae of pupal respiratory organ elongate, more or less fused at bases and enclosing inner lamellae; fourth instar larvae with seven filaments in gill tufts; seventh lateral process present; marginal armature consisting of pale fan-shaped scale-like setae (New Zealand) . . . . . subgenus *Neocurupira* Lamb.
>
> Second antennal segment twice as long as third; distal segment of maxillary palps elongate, pointed; hind legs markedly stouter; outer lamellae of pupal respiratory organ not fused at base, less closely enclosing inner lamellae; fourth instar larva with five filaments in gill tufts; seventh lateral process absent; marginal armature consisting of conical dark spines (Australia) . . . . . subgenus *Austrocurupira*.'

Species of the *kaltenbachi* group differ from *nicholsoni* in having the second antennal segment subequal to or obviously shorter than the third.

In Craig's (1969) key to Australasian genera, imagos of *kaltenbachi* and *microcephala* fall in *Neocurupira*, subgenus *Austrocurupira*, disagreeing only in respect of the number of antennal segments which is 12 in *nicholsoni*; imagos of *starmuhlneri* fall in Craig's new genus *Nothohoraia* on account of the shortness of the labial palps, but the larval and pupal instars fall in *Austrocurupira*.

Concerning *Austrocurupira*, Dumbleton (1963*a*: 255) writes: 'Australia and New Zealand appear to have shared a common stock from which *Peritheates* segregated in New Zealand. It is possible, though unproven, that *Apistomyia* segregated in Australia. The fact that the Australian species *N.* (*A.*) *nicholsoni*, whose stages were described by Tillyard . . . and Tonnoir . . . exhibits closer affinity with *Apistomyia* . . . than any New Zealand species of *Neocurupira* or even of *Peritheates*, might be taken to support this derivation.' Craig (1969) considers the relationships of *nicholsoni* are doubtful and that *Austrocurupira* has no direct 'link' with New Zealand *Neocurupira*. He also considers that *Peritheates* is a derivative of *Neocurupira*.

I believe both Dumbleton and Craig have not fully understood the relationships of *nicholsoni* because of a failure to realise that if *Neocurupira* s. str. and *Peritheates* form a monophyletic group and both are to be kept as genera, it would be illogical to maintain *Austrocurupira* as a subgenus of one of them. The following features seem to indicate unequivocally that these genera are sister-groups comprising a taxonomically isolated clade of the Apistomyinae:

(*a*) The remarkable form of the pupa; this is virtually the same throughout and is highly characteristic of the two New Zealand genera, inviting comparison with no other

known genus. The pupa is unusually deep; the middle part of the thorax is strongly convex and sharply differentiated from the lateral parts, and narrows anteriorly to the midline where there may be a somewhat mamilliform termination; the lateral portions of the thorax are curved under, so there is no sharp marginal rim, and on the upper surface are curved over into an almost horizontal plane to form a shelf bordering the domed middle part; anteriorly the lateral portions project forwards, each into a distinct swelling bearing the respiratory horn; the cephalic sclerite is strongly curved under, only a narrow part of its upper end visible in dorsal view, its lower edge deeply emarginate. The respiratory horns are situated anteriorly on the swellings on the forwardly-projecting part of the lateral portions of the thorax; the horns are directed anteriorly at first and thus project ahead of the pupa, but over a short part of their length curve strongly upwards; the individual lamellae are unusually long and the inner two are tightly enclosed by the outer two.

(*b*) The increased number of gill filaments in each tuft; there are 2, 4 and 7 in instars 2, 3 and 4 respectively. The primitive number appears to be 1, 2 and 5, and the higher number is a specialised condition which among apistomyine genera occurs only in *Neocurupira* and *Peritheates*.

(*c*) The maxillary palpi; these are two-segmented as in all Apistomyinae, but the distal segment is apically truncate with a slight to hemispherical sensory pit (figs. 1, 2) on the apex (apparently not present in *Peritheates harrisi* according to Campbell, 1921: figs. 103 and 105); such a modification does not occur in other Apistomyinae though it is known in some neotropical species of *Paltostoma* such as *lobata* Edwards (1929: 70) and *schineri* Williston (Scott, 1915: figs. 9, 10).

Figs. 1–2. Maxillary palps of (1) ♂ *Neocurupira hudsoni* Lamb, and (2) ♀ *Peritheates intermedius* Tillyard.

(*d*) The first larval instar; according to Tonnoir (1930: 201) this instar in both *Neocurupira* and *Peritheates* has a peculiar, hooked, exertile organ at the distal end of the pseudopods; he notes this structure to be absent in *Apistomyia* and *Horaia* Tonnoir (an Indian apistomyine genus), and I have not found it in the *kaltenbachi* group.

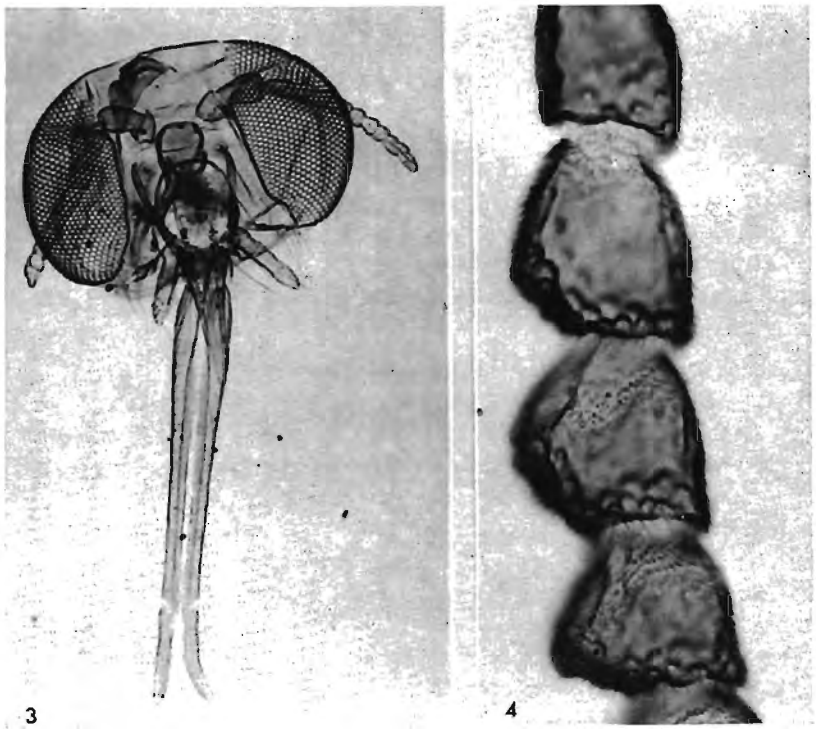
The first three characters listed are strongly apomorph and set *Neocurupira* and *Peritheates* apart from other apistomyine genera; the exertile organ of the first instar larva also indicates that these genera are closely related, but is otherwise of unknown significance as it also occurs in taxonomically remote genera such as *Blepharocera* and *Hapalothrix* (Tonnoir, loc. cit.), though a wider knowledge of first instar larvae might clarify the matter. Other characters which seem to confirm a close relationship between these two genera are the presence of pseudopods on the anal division, though this could be interpreted as a plesiomorph condition, and agreement in many minor details of structure and habitus.

The species *nicholsoni*, on the other hand, differs in respect of at least three of the four characters detailed above: its pupa is of a usual form common in various genera, the primitive number of gill filaments is present in the gill-bearing instars, and the second maxillary palp segment is apically somewhat pointed and without a special sense organ (fig. 3), in this agreeing with other Apistomyinae; the first instar larva has not been described. In view of this I propose to elevate *Austrocurupira* to full generic status.

The relationship between *nicholsoni* and the *kaltenbachi* group of species must now be considered. There are differences between them: in the adult, in the number of tibial spurs and antennal segments, proportions of labial palp segments, and nature of the eyes; in the larva, the presence of unbroken transverse ridges across the median divisions in the *kaltenbachi* group, as opposed to a different development of transverse ridges of which the equivalent ones are medially interrupted in *nicholsoni*, and differing proportionate lengths of antennal segments. Tillyard recorded mandibles as being present in *nicholsoni*, but this appears to have been an error as I have not found them in topotypical material. The imaginal differences are grade characters, except perhaps the eye structure, and therefore of no exceptional phylogenetic significance; those between the larvae are clear-cut but mostly involve features of ornamentation rather than fundamental ones of structure. There are no differences in the pupa which could be considered of importance. These data suggest that the *kaltenbachi* group can be accepted as congeneric with *nicholsoni*, but sufficiently distinct to be separated in the subgenus which is named below *Curupirina* subgen. n.

The three species of the *kaltenbachi* group form a series in respect of development of the mouthparts. In *kaltenbachi* (fig. 16) the proboscis is greatly elongate and has the distal segments of the labial palps curving outwards in typical apistomyine fashion. The proboscis of *microcephala* (fig. 28) is relatively shorter but still of normal structure. In *starmuhlneri* (fig. 41) the proboscis is much reduced, lacks pseudotracheae, and has the distal and proximal labial palp segments fused. A reduction comparable to that of the last-named species is found in *Neocurupira campbelli* Dumbleton (1963*a*: 242) which has labial palps only subequal to the depth of the head and according to Craig (1966) lacks pseudotracheae, but retains the division of the labial palpi into proximal and distal segments and has the distal areas appressed to one another and not diverging. A reduction of the degree found in these two species represents a regressive state as the loss of pseudotracheae presumably restricts the ability to feed. That it is a regressive state is demonstrated by the presence in

the pupa of *campbelli* of labial palp sheaths longer than the palps of the imago which do not fill them (Craig, 1966); a comparable case is provided by *curtirostris* n. sp. considered below.



Figs. 3–4. (3) *Austrocurupira nicholsoni* (Tillyard) ♀ head; (4) *A. starmuhlneri* n. sp., flagellar antennal segments.

There are a number of features in the imaginal anagenesis of Blepharoceridae which are difficult to understand; the extraordinary variety of eye structures is one and variation in development of the mouthparts another. Very reduced mouthparts have appeared independently in several sections of the family, but in the Apistomyinae the reduction has affected a type of labial structure already notably specialised in comparison with the usual form. Obviously loss of the pseudotracheae and reduction must be associated with some shift in habits, and indeed this is suggested by Craig's (1966) observation that *campbelli* imagos occur commonly on the underneath surface of rocks closely overhanging the water of quiet pools below rapids and cascades, whereas the adults of other New Zealand species usually rest in the hygropetric zone of rocks in rapids. It may be significant that a correlation often exists between reduction of mouthparts and form of the antennae. In *starmuhlneri* (figs. 4, 41) the antennae show a modification not found in the two related species, most of the flagellar segments being subglobular with an alveolar sensory area on the apical surface. Similarly, in *campbelli* most of the flagellar segments are short and deep,

and the whole antenna is compact (Dumbleton, 1963*a*: fig. 1f); and in *Edwarsina dispar* Edwards (1929: 52) the male has normal antennae and mouthparts, whereas the female has very short antennae with subglobular flagellar segments not decreasing in diameter towards the apex of the antenna, and much reduced mouthparts. The same correlation is found in *Nothohoraia*.

Before closing this section, I must draw attention to the relatively unusual form of the proboscis in *nicholsoni* (fig. 3), which is illustrated by Tillyard (1922). It should be noted that Tillyard's figs. 2c and 2d are incorrect in showing a transverse division in the proximal segment of the labial palps at the level of the apex of the labrum. What is unusual is the shortness of the curved distal segments in comparison with the elongate proximal segments of the labial palps (about 23:75 in ♂, 20:66 in ♀) and the separation of the proximal segments over part of their apical length (about $\frac{1}{2}$ in ♂, $\frac{2}{3}$ in ♀). Apart from this partial separation of the proximal segments, the proboscis of *nicholsoni* appears to be not far removed from the paltostomine type and suggests that this species may be the most primitive apistomyine known.

2. The species *curtirostris* sp. n.: as this species is represented in the imaginal stage by the female only, a discussion of its relationships must be incomplete. The species is highly remarkable on account of the extreme reduction of the mouthparts which are represented by minute, presumably functionless vestiges only (figs. 59, 61); this is the greatest reduction known in the family, exceeding that of the Central Asian *Tianschanella monstruosa* Brodsky (1930) which still retains relatively normal maxillary palps. Other characters are the undivided eyes, unforked *Rs*, absence of tibial spurs, and low number of only nine antennal segments. The fourth instar larva has two-segmented antennae, five gill filaments in each tuft, no spines on the pseudopods (unlike other New Caledonia blepharocerids), but one strong, erect spine adjacent to the midline on each of the median divisions, the anal division broadly fused with the fifth median division, and the seventh pair of pseudopods vestigial. The only notable features of the pupa are the extreme slenderness and weakness of the two inner respiratory lamellae, and the presence of elongate labial palp sheaths.

The problem of deciding in which subfamily this aberrant species falls fortunately appears to be conclusively settled by the very elongate labial palp sheaths of the pupa (fig. 62), which indicate that *curtirostris* is a highly modified apistomyine, originally with a proboscis like that of *kaltenbachi*, in which reduction of the mouthparts and number of antennal segments has been carried very far. The losses of R_{2+3} and tibial spurs are grade characters of diagnostic but little other value.

In the key to genera provided by Alexander (1958) *curtirostris* runs out at *Horaia* Tonnoir (1930), an Indian genus, on account of the number of antennal segments, a reasonable result as this species obviously would be misplaced in the other genera with unforked *Rs*, namely *Apistomyia*, *Hammatorrhina* and *Peritheates*. However, the species of *Horaia* differ in having normal though slender apistomyine mouthparts, tibial spurs 0.0.2 and the eyes of the female divided in some of the species. The larval stages of *curtirostris* differ from those of other apistomyine genera as follows. Larvae of *Apistomyia* differ in their distinctive body form, the presence of transverse ridges formed of strong granulations or spines, which clearly divide the first four median divisions into three sections, and in having the seventh pair of pseudopods present though small. In *Neocurupira* and *Peritheates* there

is a higher number of gill filaments in each tuft in all the gill-bearing instars, a well-developed seventh pair of pseudopods, and a different habitus. Larvae of *Horaia* have a characteristic body form (Tonnoir, 1930: figs. 42–44), distinctively shaped pseudopods, and spines (when present) in the midline of the dorsum as in *curtirostris* but in the last instar only. The larvae of *Nothohoraia* are unique in respect of their highly modified body form. From precinctive *Curupirina* larvae and the larval stages of *Austrocurupira nicholsoni*, *curtirostris* differs in having dorsal spines (these irregularly absent on various of the median divisions in fourth instar specimens). In terms of similarities, larval *curtirostris* has more features in common with *Austrocurupira* s. lat. than any other genus; the most important of these are the development of transverse bands of strong sclerotisation across the median divisions, presence of a hard, asetose hind margin on the anal division, and the greatly reduced seventh pseudopods which bear a long, strong, curved seta; as in *nicholsoni*, the anterior sclerotised band is interrupted medially.

Thus it appears that the female imago of *curtirostris* is unlike any other described apistomyine, whereas the larval instars have some resemblance to those of species of *Austrocurupira*. There seems to be no other course than to establish the new genus named below *Nesocurupira*, for this aberrant species.

It would be reasonable to assume that *Nesocurupira* is a specialised offshoot from precinctive *Austrocurupira* stock, but a single feature indicates that this might not be so. The monotypic New Zealand apistomyine genus *Nothohoraia* Craig (1969) has a very distinctive larva, *Rs* branched, 14-segmented antennae, eyes divided in both sexes, maxillary palpi as in *Austrocurupira*, and shortened mouthparts rather like those in *Neocurupira campbelli* (though in the female the galea is absent), the distal palp segments being short, relatively stout and not curved outwards. The nature of the larva, pupa and maxillary palps shows conclusively that *Nothohoraia* has no close relationship with precinctive *Neocurupira* and *Peritheates*, and Craig considers the genus allied to *Horaia* on the grounds of larval structure. In *Nothohoraia* the larval maxilla is unusual in that the palpal broom sclerite is extended aborally in a rather narrow lobe; the larval maxilla of *Nesocurupira* (fig. 71) is formed in exactly the same way. The only other genus I know of in which a comparable conformation is found is the paltostomine *Hapalothrix* of central Europe (see Bischoff, 1932: fig. 6b). The sister-group of *Nesocurupira* may therefore be *Nothohoraia*.

3. *Genus et species incertae sedis:* represented by a fourth instar larva strikingly different from those of the species of *Curupirina* and *Nesocurupira*. Its morphological features are described below. This larva is unlike that of any known apistomyine, and in fact is quite similar to the same instar of some South African species of *Elporia* Barnard, apart from a few minor differences in arrangement of spines. It may indeed be a paltostomine.

CONCLUSIONS

The presence of Blepharoceridae in New Caledonia is a further and important piece of evidence for the biogeographic significance and antiquity of this island, and for the possibility of former connections to neighbouring land masses. Both direction and distance of relationship seem appropriate to the position and isolation of New Caledonia. Affinities are to Australia and possibly New Zealand; the ultimate source of this blepharocerid fauna seems to have been South-East Asia.

Although the assemblage of species in New Caledonia is an interesting one, it provides little information useful for interpreting the evolutionary history of the family in general or of the Apistomyine in particular, though it may be more meaningful when the Asian fauna is better known. Fig. 11 represents the possible phylogeny of the Apistomyinae as far as it can be inferred from available data. There appear to be three main divisions within the subfamily (the position of *Hammatorrhina* being unknown through lack of data); firstly, *Apistomyia*, which is distinguished by many features including an unusual conformation of the radial-sector and the invariable presence of mandibles, and which has a wide but internally consistent distribution; secondly, the *Austrocurupira* group of genera, including *Horaia*, *Neocurupira* and *Nothohoraia*, which may yet be found in the chain of transtropical islands between the Australasian and Indian centres; thirdly, the *Neocurupira-Peritheates* line, which shows no close relationship to any other. If 'Hennig's Principle' (Brundin, 1965) is applied, the last-named can be regarded as the sister-group of all other Apistomyinae, and one could argue from this that this line has the status of one of the older, relict elements in the New Zealand fauna. However, we seem to have nothing more in the Australasian Apistomyinae than a fragmentary fauna in which anagenesis has proceeded unequally and cladogenesis in some lines is apparently quite recent; doubtless the turbulent geological history of the Inner Melanesian Arc has been a contributory factor. Any inference of relationships and evolutionary events is therefore barely more than speculation.

TAXONOMY

Subfamily *APISTOMYINAE*

Genus *Austrocurupira* Dumbleton, **New Status**

Austrocurupira Dumbleton, 1963, *N.Z. J. Sci.* **6** (2): 251. (As a subgenus of *Neocurupira* Lamb, 1912) Type species by monotypy, *Neocurupira nicholsoni* Tillyard, 1922.

An apistomyine genus with radial-sector forked, R_{2+3} thus present, second segment of maxillary palps subcylindrical to subfusiform with moderately pointed apex which has no special sensory pit, ♀ without mandibles, tarsal claws not toothed below; fourth instar larva with five gill filaments in each tuft, seventh pseudopod greatly reduced but bearing a long seta, hind margin of anal division asetose, median divisions with transverse ridges developed in varying degrees and with marginal vestiture composed of spine-like setae, pseudopods with spine-like setae, palpal broom sclerite simple and not with a reflexed aboral lobe; pupa unspecialised, thorax with a sharp marginal rim, respiratory processes composed of four simple, quite widely spaced lamellae directed upwards, outer lamellae meeting on inner ends only and not closely enclosing inner lamellae, outer lamellae narrowly subtriangular, inner lamellae of various shapes.

Subgenus *Austrocurupira* s. str.

Imago: Antennae 12-segmented; eyes sexually dimorphic, holoptic and subequally divided in ♂, dichoptic and unequally divided in ♀; tibial spurs 0.0.2; hypopharynx well developed; proximal section of labial palpi greatly elongate, distal segments much shorter; second antennal segment about twice as long as third.

Larva: Anterior margin of each median division with a strongly sclerotised transverse ridge narrowly interrupted medially; length of antennal segments very unequal in final instar, basal segment about one-fifth apical segment and annulus-like; mandible inner lobe deeply serrate on middle part of cutting edge; fifth median division completely fused with anal lobe.
Pupa: Without good distinguishing characters.

Austrocurupira nicholsoni (Tillyard)

Neocurupira nicholsoni Tillyard, 1922, *Austr. Zool.* **2** (4): 167. Tonnoir, 1923, ibid. **3** (2): 57; **3** (4): 139. Dumbleton, 1963*a*, *N.Z. J. Sci.* **6** (2): 236, 251.

Although Tillyard's description is quite comprehensive, some additional data require mention. Tonnoir's account of the immature stages is incomplete in several respects, so notes are given on these as far as available material permits.

♀. Frons bulging, somewhat domed, ocellar tubercle prominently raised, turret-like, placed far back on head, ocelli large; eye division definite, facets in upper division equal in size to those in lower one. Maxillary palp almost half length of labrum (13 : 28); labrum with abundant trichoid sensillae in two longitudinal series on inner surface; hypopharynx strongly formed, only a little shorter than labrum, not serrated marginally; pseudotracheae present; mandibles absent; distal segment of maxillary palpi much longer than proximal one, bluntly pointed, setose but without any specialised sensory areas; antennae 12-segmented, but several segments abnormally or incompletely sclerotised, some suggesting by their shape a fusion of two segments; microtrichia of wing membrane minute, weak.

4th instar larva: On each median division are three transverse swellings in cuticle; one follows anterior margin of upper surface, laterally thinning away and merging with ridge of spines, but towards midline broadening considerably, not continuous but narrowly interrupted in midline of body, on each inner end a small swelling paler than surrounding area with a single or double dark central spot suggestive of a small tubercle formerly bearing spine-like setae though no trace of these; paramedially is a deeply impressed group of sigillae or muscle scars, and extending outward from this group a linearly arranged series of small but deeply impressed fovea-like sigillae; between large groups of sigillae is a transverse, longitudinally quite broad swelling of integument, complete across midline, not extending beyond sigillate area; another transverse swelling on hind margin of dorsal surface, narrow and following curve of division, thus concave posteriorly, complete across midline, subequal in width throughout, terminating laterally just beyond or beneath large sigillate areas; these three transverse swellings on median divisions 1–4 separated from one another by less than their own width; on cephalic division transverse swellings equivalent to all three of median divisions can be discerned, though these much more widely spaced, anterior one recurved on sides; on fifth median division posterior swelling absent. Maxilla as in fig. 12, lacinial pad relatively large, with strongly curved, pectinate teeth arranged in about 10 or 11 rows, lower part of lacinial pad densely fringed with microsetae; palpal broom sclerite simple, its sense organs concentrated near base. Mandible as in fig. 13.
Pupa: Tonnoir's drawing incomplete in that none of usual sutures of thorax are shown; his figure of respiratory process also misleading—first and fourth lamellae not enclosing closely inner lamellae, quite widely separated at outer ends, inner ends curving to meet one another. Cephalic sclerite as in *Curupirina*.
Material examined: Topotypical ♂, ♀, 3 fourth instar larvae, two pupae.

Subgenus **Curupirina** n. subgenus

Distinguished from nominate subgenus as follows:

Imago: Antennae 14-segmented; eyes not sexually dimorphic, dichoptic, with a small upper division containing mostly reduced or vestigial facets; spurs 0.0.1; hypopharynx much reduced; labium variously proportioned but not with apical diverging segments much shorter than basal segments; second antennal segment subequal to or obviously shorter than third segment.

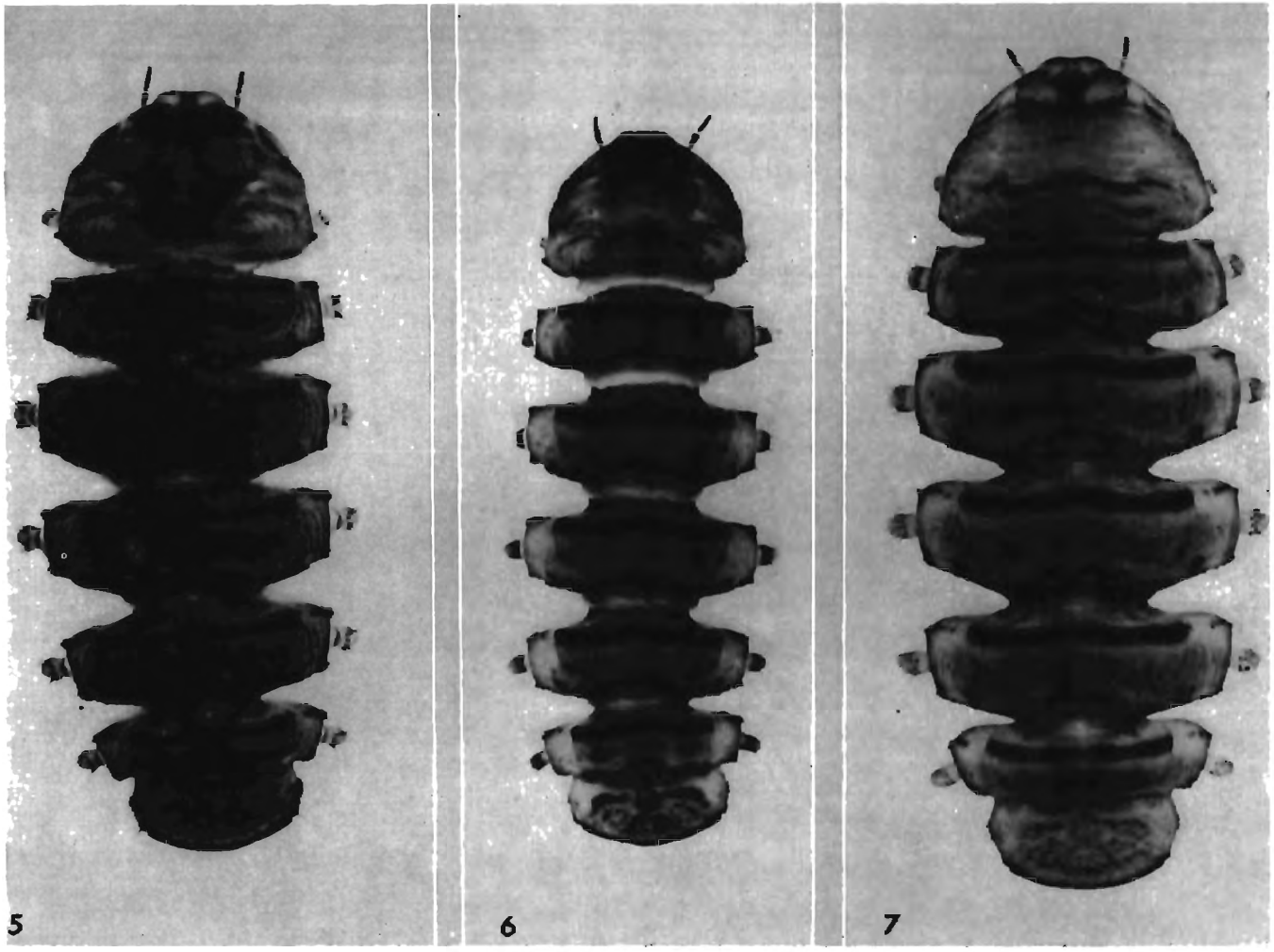
Larva: With strongly formed, darkly coloured, transverse ridges on anterior margins of median divisions, these ridges not interrupted medially; antennal segments subequal in length in final instar; no serrated cutting edge on mandibular lobes; anal lobe not completely fused with fifth median division in last instar.

Pupa: Without clear-cut distinguishing characters (figs. 45, 52).

Type species, *Austrocurupira kaltenbachi* n. sp., described below.

The larval instars: As the larvae of the three species are very similar the following description is applicable to them all with the exception that the first instar is known only for *starmuhlneri* and only the third and fourth instars are available for *microcephala.* Diagnostic characters separating the larvae are given for each of the species in their descriptions.

4th instar: Body (figs. 5–7) of usual blepharocerid form, in outline elongate elliptical, constriction between divisions quite deep, but anal division broadly fused to fifth median division; six pairs of pseudopods present, seventh pair on anal division represented by small, immovable swellings bearing a long seta. Head capsule of usual conformation, incision in lateralia elongate subtriangular, reaching antennal fovea; clypeal margin sharp, fused anterior ends of dorsal ecdysial lines reaching anterior margin, thus apparently dividing clypeus in midline; a strong marginal proclinate seta on each side of clypeus; mandibles bilobed, without serrations on cutting edge; maxillae with relatively small lacinial pad, lacinial teeth strongly curved and pectinate, like arched combs, arranged in 9–11 rows; aboral side of sensory disc plate with few and inconspicuous sense organs; lobe of palpal broom simple, its sense organs confined to basal part; a thick fringe of hairs on adoral edge of sensory plate. Antenna two-segmented, basal segment thicker than, in length subequal to, apical one. Dorsal surface of each median division with a strongly sclerotised transverse ridge anteriorly just behind neck-like portion, this ridge raised and forming a sharp anterior margin to dorsal surface, not extending completely across division but stopping abruptly on each side, in total length ridge occupying about $\frac{3}{4}$ of width of division, these ridges conspicuous on account of strongly contrasting colour; first four median divisions also with a transverse sclerotised strip along hind margin of dorsal surface, following shape of division and thus arched over middle section, concave posteriorly, not extending laterally as far as anterior ridge, more reddish-brown than surrounding integument but not conspicuously coloured like anterior ridge. Hind margin of anal division strongly and darkly sclerotised, not fringed with hair or setae. Pseudopods rather narrow, short subcylindrical, moderately flaring at base, with well-developed dorsal apodeme at middle of dorsal edge. Five gill filaments in each tuft, three directed anterad, two posterad, inner one of posterior pair conspicuously larger than others. Stout, spine-like setae present on pseudopods, on anterior and posterior lateral edges of median divisions, in a small, closely packed group



Figs. 5–7. Fourth instar larva of *Austrocurupira* species; (5) *kaltenbachi* n. sp. fully grown larva with pupal respiratory lamellae and integument visible through skin; (6) *starmuhlneri* n. sp. young specimen, (7) *microcephala* n. sp. large specimen. All to same scale.

at outer end of transverse ridges, on hind corners of cephalic division and lateral margin of anal division. Smaller spine-like setae present on lateral and ventro-lateral surfaces of cephalic division. Setae variously developed on upper surface of pseudopods. On ventral surface of cephalic division three quite strong setae on each side in longitudinal rows. Roughened surfaces, composed of minute angular asperities (fig. 35), in longitudinal strip on each median division adjacent to pseudopod, also bordering continuously entire margin of anal division, and a small patch on cephalic division at posterior lateral corner of ventral surface.

Colouration in the three known species is very uniform; dorsal surface reddish-brown with a yellowish tinge variously developed (especially strong in *microcephala*); transverse ridges very dark and strongly contrasting, hind margin of anal division also narrowly dark; antennae dark to blackish brown; head capsule variously coloured in different species; pseudopods more yellow tinged than remainder of body, 'soles' of pseudopods pale orange; transverse sclerotised strips on hind margin of median divisions darkish brown, more shining than remainder of integument; ventral surface whitish.

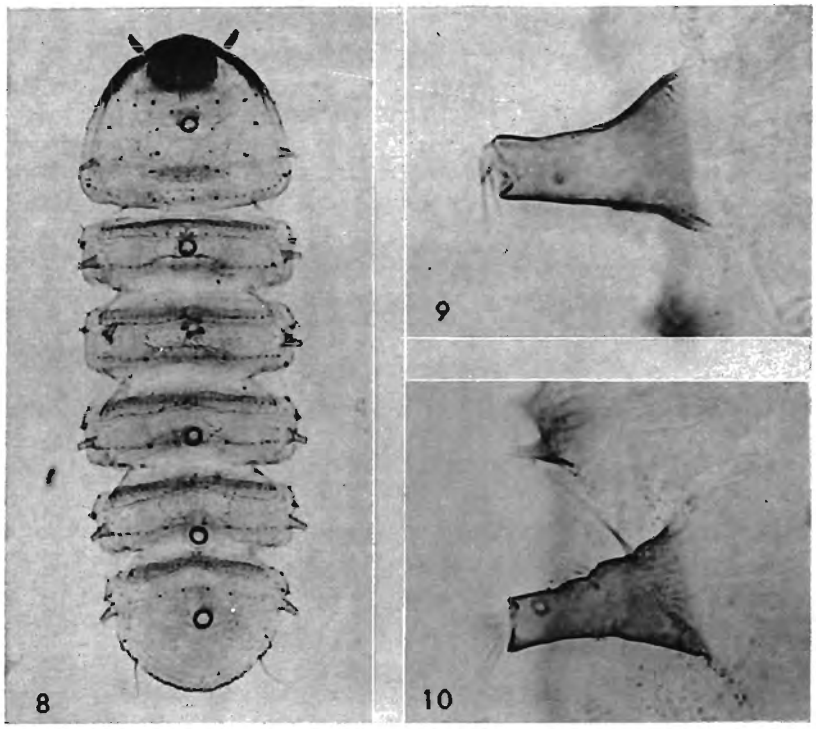
3rd instar: Three gill filaments in each tuft, two directed anteriorly, one posteriorly. Antennae two-segmented, basal segment a little less than half apical one (3·5 : 7·5), apical segment more slender than basal one, especially over apical third or so. Pseudopods with only a few (1–4, depending also on species) spines.

2nd instar: One gill filament present on each side, directly anteriorly. Antennae two-segmented, basal segment much shorter (5 : 13) than apical segment which moreover is more slender than basal one and is quite abruptly narrowed over apical third; pseudopods without spines, only with setae; roughened surfaces, consisting of relatively few transversely elongate asperities proportionately larger than in later instars, present adjacent to pseudopods, no roughened surface along hind margin of anal division; transverse rows of very small, suboval setae present on ridges of median divisions, and four such setae in a row at hind margin of each median division, quite widely spaced.

1st instar: Gills absent, antennae unsegmented. Body form (fig. 8) essentially a miniature of later instars, transverse ridge on anterior margin of median divisions already apparent, also cuticular thickening at hind edge of these divisions. Cephalic sclerite with egg burster, a linear ridge in longitudinal midline of frons. Pseudopods as in figs. 9, 10, short-cylindrical apically, widening basally, truncate apically, without an exertile organ at tip, instead with stiff setae; spines absent, only two or three setae on anterior face of pseudopod. A vertical row of 2–3 short, stout setae on lateral end of median divisions anterior to pseudopods, and what appear to be minute, scale-like setae arranged in two transverse rows across median divisions, setae quite widely spaced in these rows, anterior row a short distance behind transverse ridge; scale-like setae also in row around postero-dorsal margin of cephalic division and in three rather poorly defined rows. Seventh pair of pseudopods represented by small, setiferous, wart-like protuberances; ventral surface without roughened patches.

Austrocurupira (Curupirina) kaltenbachi n. sp.

Diagnostic Characters; ♂ ♀. Antennal flagellar segments without a differentiated alveolar area; mouthparts elongate, labial palps about $1\frac{2}{3} \times$ transverse diameter of head and clearly divided into basal and apical segments; eye with a small but clearly demarcated upper area



Figs. 8–10. *Austrocurupira starmuhlneri* n. sp.; (8) first instar larva; (9, 10) pseudopods of same specimen.

containing normal and reduced facets; microtrichia on wing membrane hair-like, not clustered. Dorsum of pupa appearing relatively smooth, only finely granulate, tergites 1 and 2 with particularly weak granulation, but these granules in fact no smaller than in other species, being relatively inconspicuous owing to pale colour; individual granules with a microsculpture of fine points which is darker than granules and suggests the fineness of the granulation; thorax without obvious granulation. Fourth stage larva (fig. 5) easily distinguished from that of *microcephala* (fig. 7) by the dark cephalic sclerites and darker and relatively shorter spines on the pseudopods and elsewhere; distinguished from that of *starmuhlneri* by the more numerous spines on lateral margins of anal division, and short, inconspicuous hairs on pseudopods.

♂ Head (fig. 16) transverse; eyes with very fine, short, inconspicuous hairs; eyes divided (fig. 17), a small dorsal portion clearly separated by an unfaceted strip, with some normal facets centrally and reduced facets peripherally; eyes dichoptic, frons more or less parallel-sided, in width about $\frac{1}{4}$ of transverse diameter of head. Ocellar tubercle prominently raised. Antennae 14-segmented; first flagellar segment length about equal to that of 4 and 5 together, flagellar segments 4–13 submoniliform, apical segment smaller; entire antenna $1\frac{1}{2}\times$ as long as transverse diameter of head; flagellar segments unspecialised, without apical alveolar area found in *starmuhlneri*. Labrum narrowly elongate-triangular, its length

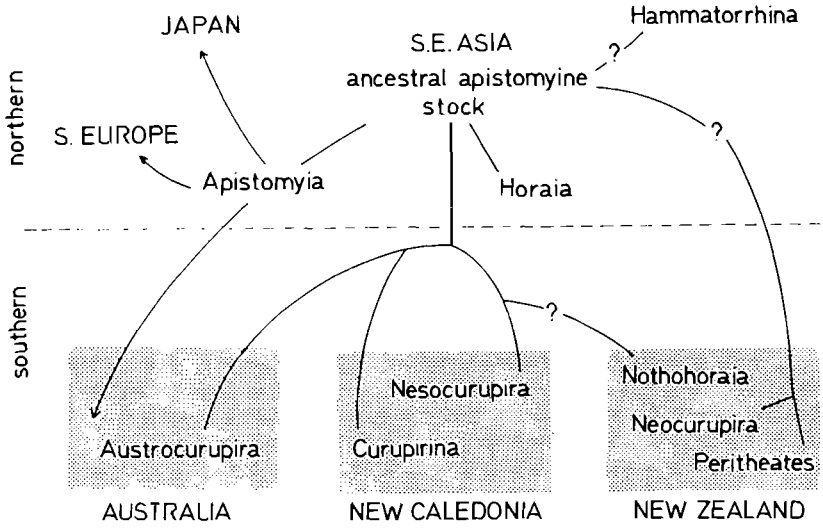


Fig. 11

about one-half transverse diameter of head; Hypopharynx quite well developed though much shorter than labrum, with a median trough, apex subacute; maxillary palps small, two-segmented, basal segment short, without setae, apical segment a little less than 3 × as long as broad, tapering apical, with some setae, palp length between $\frac{1}{2}$ and $\frac{1}{3}$ of labial length; galea a short blade a little larger than palp. Labium conspicuously elongate, in length when straightened a little more than 3 × depth of head or about $1\frac{2}{3}$ × its transverse diameter; labial palps clearly divided as usual into proximal and distal segments, division at about basal third; distal segments narrow, slender, divergent, pseudotrachea extending to tip.

Mesonotum without setae. Scutellum setose, with setae more numerous on lateral parts, occupying a zone that tapers inwards but does not reach median line. Tibial spur on hind-leg quite long, much longer (12 : 7) than diameter of hind basitarsus; tarsomeres proportioned as given below (Table 1):

TABLE 1

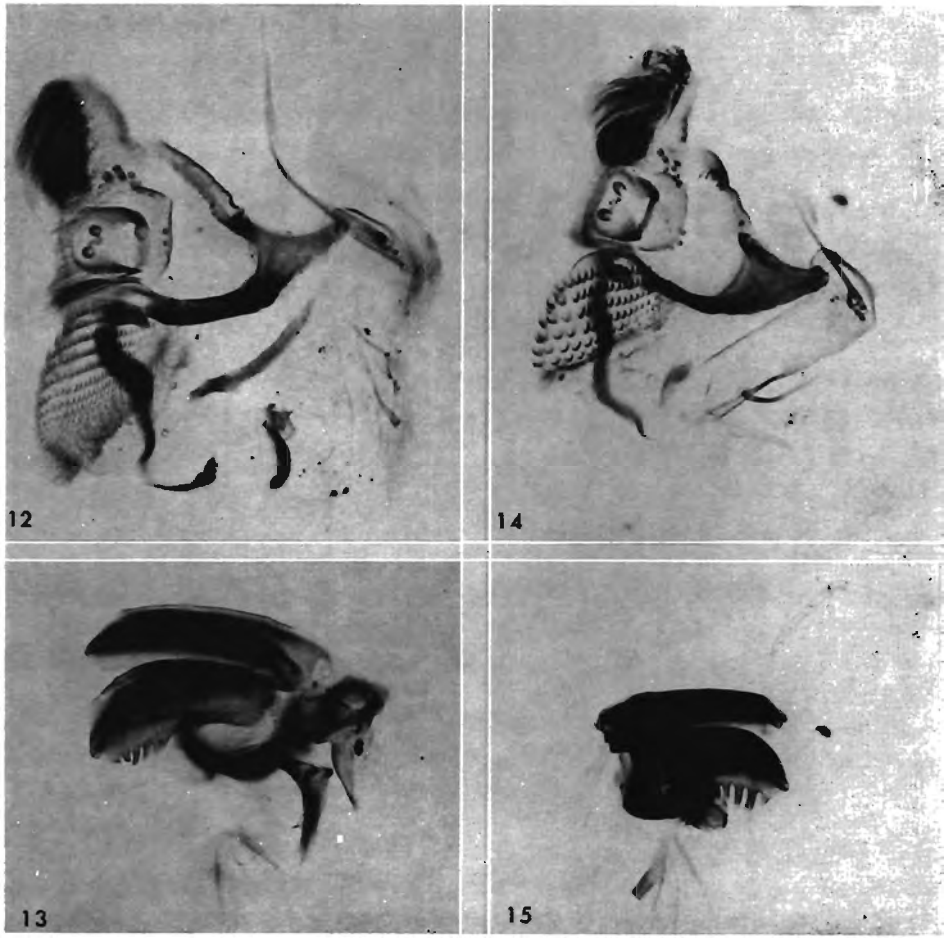
PROPORTIONATE LENGTH OF TARSOMERES OF A. KALTENBACHI

	Basitarsus	2	3	4	5
♂					
Fore-leg	32	16	14	11	14
Mid-leg	23	11	10	9	12
Hind-leg	37	13	12	9	10
♀					
Fore-leg	33	11	8	8	15
Mid-leg	24	8	5	5	13
Hind-leg	42	15	11	9	14

Claws as in fig. 18, unremarkable, curving over quite strongly, without teeth, only some fine hairs below basally. Wing as described below for ♀; *An* apparently running almost parallel to basal section of *Cu*, but represented only by a little less than its basal half, remainder apparently absent.

Hypopygium (figs. 21, 22) as figured; dististyles relatively short, not narrowed near base; synsternite semimembranous; cerci more or less rounded in lateral view.

♀ Head very like that of ♂, sexual dimorphism slight; eyes similarly formed, but upper division proportionately a little smaller than in ♂, with fewer facets; frons relatively a little wider than in ♀, about ⅓ width of head. Antennae 14-segmented, apparently somewhat malformed (fig. 16) in this specimen, the flagellum not submoniliform but subcylindrical, antennal length exactly equal to transverse diameter of head; on the left antenna the 9th and 12th segments are not completely encircled by sclerotisation, on right antenna segments 9 and 13 so formed, sclerotisation interrupted by an irregular longitudinal narrow membranous strip. Proboscis 1½× width of head, proportionately a little shorter than in ♂, otherwise mouthparts as in ♂. Wing like that of *starmuhlneri* (fig. 44) in venation, but *Cu* not attaining margin; *An* indistinct, apparently shorter than in figure and more widely



Figs. 12–15. Fourth instar larval maxilla and mandible of (12, 13) *Austrocurupira nicholsoni* (Tillyard), and (14, 15) undetermined genus and species from New Caledonia.

separated from *Cu*; microtrichia obvious as small setae at ×125 magnification, evenly spaced, no tendency to cluster; wing membrane brownish; length of R_4 in relation to R_5, 34 : 74, angle between them moderately acute. Proportionate length of tarsomeres in Table 1 above. Genitalia (fig. 23) characterised by elongate oviscapt; each oviscapt lobe with a dorsal group of closely-packed, short, blade-like setae, quite far from apex, difficult to count but about 12 in each group; three elongate ovoid spermathecae present.

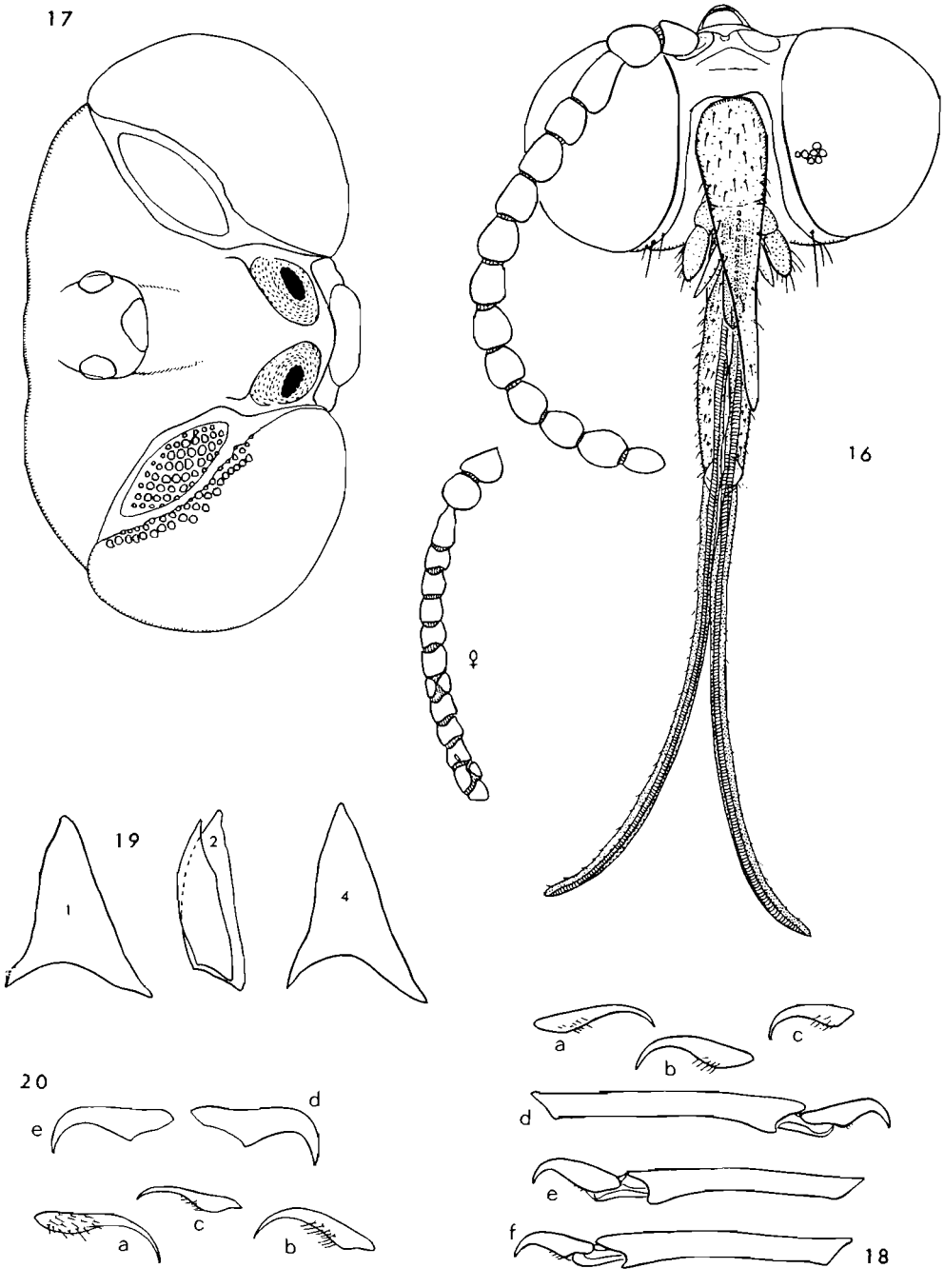
Pupa: Yellowish-brown to dark brown, depending on age. Respiratory lamellae as in fig. 19; anterior and posterior lamellae blackish, curving to meet one another at inner ends; second and third lamellae pale testaceous, much narrower than others, somewhat sinuous, strongly tapering; lamellae divergent apically. Dorsal surface, except for thorax, finely and evenly granulate (figs. 39, 40), individual granules like somewhat flattened blisters, each bearing a microsculpture of very fine, dot-like elevations numbering normally about 4 but often as many as 7, this microsculpture darker than granule and responsible for the seeming fineness of the granulation in reflected light at low power, the granules themselves not much different in colour from surrounding integument; thorax smooth, apart from a few very weakly developed granules on posterior part around midline (these best seen in transmitted light).
Size of pupa: 4·6 × 2·6 — 4·3 × 2·6 mm.
Length of larvae: 4th instar, 4·9 — 5·7 mm; 3rd instar, 3·9 mm.

Material examined: Holotype ♂, ♀, larvae, pupae; New Caledonia, loc. FNK 97, 7 September 1965; 'Sturzbach an der Strasse von Hienghène nach der Baie d'Ouaième, tief eingeschnitten, nicht beschattet, der Bach entwässert die Roches d'Ouaième des Massiv de Tonnon aus einer Höhe von 982m, starkes Gefälle, mehrere Meter hohe Kaskaden wechseln mit Kolken, CA 100m vor der Mündung ins Meer, Niaouli-Savanne. Seehöhe 30m'. Two pupae; loc. FNK 94/2, 6 September 1965; 'Oberlauf d. R. Hienghène beim Dorf Kavatch, tief eingeschnitenes Tal mit Niaouli-Savanne und Urwald, aber nicht beschattet. Seehöhe 25m.'

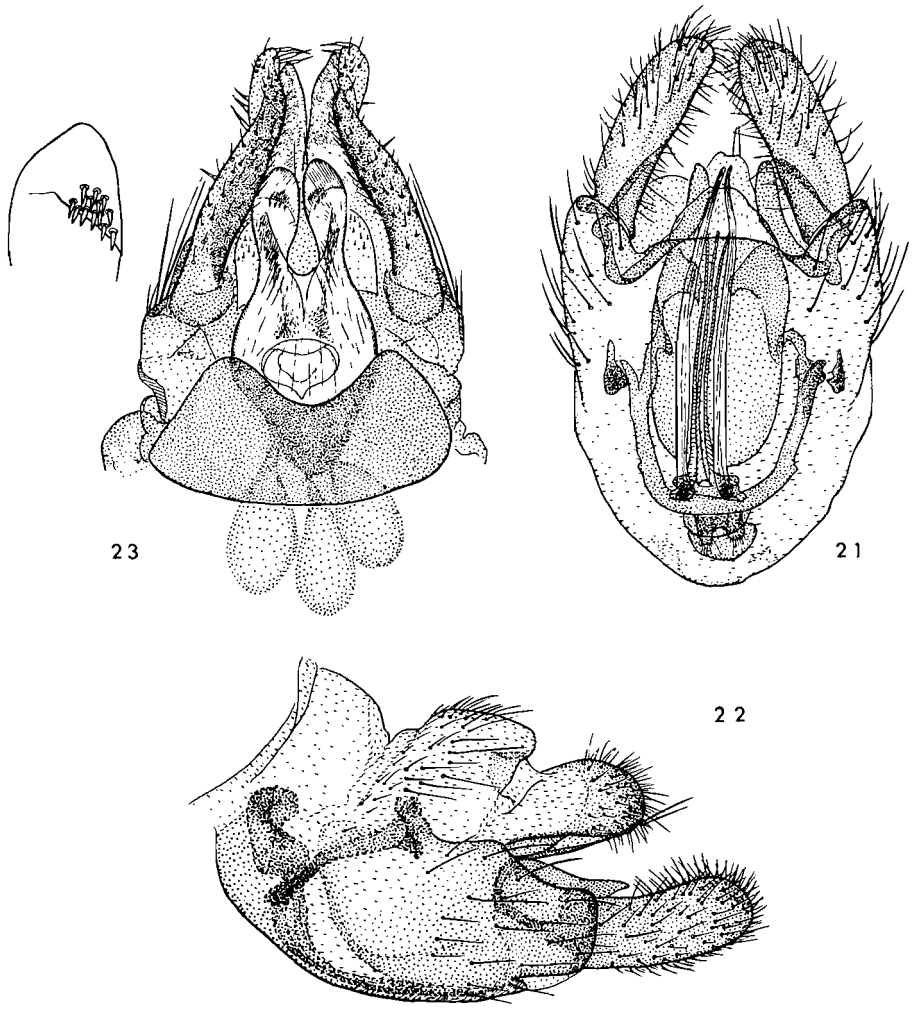
Austrocurupira (Curupirina) microcephala n. sp.

This species is represented by two puparia and several larvae; one puparium contains a perfect pharate female, the other a pharate male which unfortunately is lacking its head as a result of accidental damage during collecting. The female therefore is made the holotype.

Diagnostic characters: ♀. Antennal flagellar segments with some alveoli, but not modified in shape; mouthparts moderately elongate, in length between those of *kaltenbachi* and those of *starmuhlneri*, labial palps a little shorter than transverse diameter of head and with a definite division into usual distal and proximal sections; eyes with clearly demarcated division in upper corner containing only much reduced facets; microtrichia normal and not clustered. Pupa without obvious granulation on thorax; individual granules with a microstructure of black dot-like elevations similar to those in *kaltenbachi* but darker, more obviously contrasting with remainder of granule. Fourth instar larva (fig. 7) differing from that of *kaltenbachi* and *starmuhlneri* in generally lighter coloration which shows a stronger tinge of yellow, also the cephalic sclerites pale brownish-yellow narrowly bordered with dark brown and not extensively dark; spines (fig. 24) numerous as in *kaltenbachi*, but



Figs. 16–19. *Austrocurupira kaltenbachi* n. sp.; (16) ♂ head, frontal, inset ♀ antenna to same scale; (17) ♂ head, dorsal; (18) claws of ♂ *a–c*, of ♀ *d–f*, *a* and *d* claw of fore leg, *c* and *f* claw of hind leg, *b* and *e* claw of middle leg; (19) right respiratory lamellae, posterior view, anteriormost numbered as 1. Fig. 20. *Austrocurupira microcephala* n. sp. claws, *a–c* of ♂, *d–e* of ♀, *a* of fore leg, *b* and *d* of middle leg, *c* and *e* of hind leg.



Figs. 21–23. *Austrocurupira kaltenbachi* n. sp.; (21, 22) ♂ genitalia, ventral and lateral; (23) ♀ genitalia, ventral, inset inner surface of oviscapt lobe showing group of setae.

longer and paler than in that species; pseudopodal hairs inconspicuous and short. ♀. Head (fig. 28) transverse, relatively small, obviously narrower than mesonotum (head width 31, mesonotal width measured at inner ends of transverse sutures, 42); eyes widely separated; frons almost parallel-sided, at lower end its width in relation to head width 12 : 31; head thus about $2\frac{1}{2}\times$ width of frons; eyes divided (fig. 29), a small area separated at upper corner, this enclosing several much reduced facets the largest of which is a little less than half size of facets in remainder of eye, majority of facets in this area minute and probably vestigial, this area also with erect hairs like those distributed over eyes. Ocellar tubercle moderately prominent. Antennae 14-segmented, in length slightly larger than width of head; scape and pedical a little stouter than other segments, first flagellar segment

longer than others, remainder submoniliform, terminal one conspicuously smaller; flagellar segments with a definite though moderate development of alveolar sensory pits, these fairly generally distributed on each segment though not near base, however these pits not associated with any marked change in shape of individual segments. Labrum narrowly elongate-triangular, over its apical half exceedingly narrowed, its length about 65% of width of head; hypopharynx well developed but short, its apex not nearly reaching midlength of labrum; maxillary palpi as figured, small, two-segmented, both segments with some strong setae, apical segment roughly fusiform, its greatest diameter near middle and about $\frac{1}{3}$ of length; galea a narrow blade, obviously extending beyond apex of palp; labial palps moderately elongate, length a little less ($\frac{9}{10}$) than transverse diameter of head; labium clearly divided into proximal and distal sections, division at about midlength, palpi narrow, slender, apically divergent, each containing a well-developed pseudotrachea attaining apex.

Mesonotum with some setae in dorsocentral rows and on disc posterior to transverse sutures, scutellum with many setae, these more closely packed by shorter on lateral parts. Tibial spurs 0.0.1, hind spur long and slender, longer than diameter of hind basitarsus (16 : 6). Tarsomeres with the following relative lengths (Table 2):

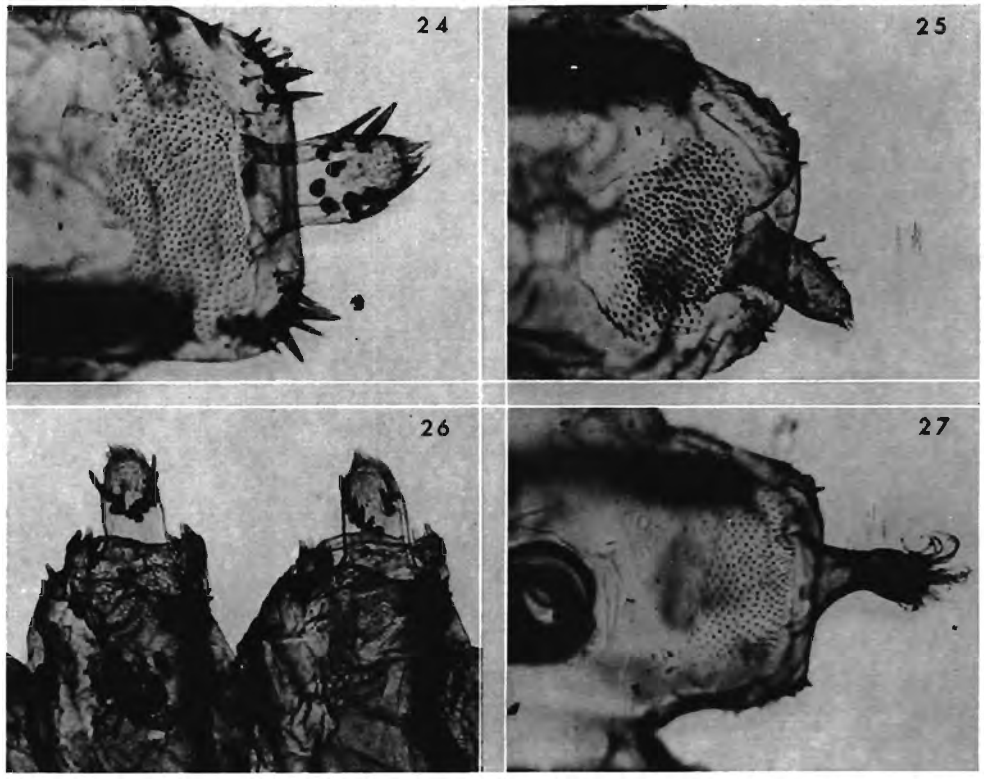
TABLE 2

PROPORTIONATE LENGTH OF TARSOMERES OF A. MICROCEPHALA

	Basitarsus	2	3	4	5
♀					
Fore-leg	55	21	15	11	25
Mid-leg	40	14	10	9	21
Hind-leg	61	27	18	14	23
♂					
Fore-leg	49	28	25	21	24
Mid-leg	34	19	17	16	21
Hind-leg	58	23	17	14	18

Claws as in fig. 20, fore claw a little more shallowly falcate than those of other legs; no teeth below, only some minute hairs basally. Wing venation as in *starmuhlneri* (fig. 44), R_4 present, its length relative to that of R_5 being 40 : 95; *Cu* apparently not attaining margin; *An* subparallel to *Cu*, apparently ending some distance from margin; microtrichia of membrane normal, small, evenly-spaced setae; R_1 setose over all its length. Genitalia (figs. 31–33) in general similar to that of *kaltenbachi* and *starmuhlneri*, differing from both in small details of shape and structure; three ovoid spermathecae present.

♂. Mesonotum with a few fine setae in dorsocentral rows, scutellum quite abundantly setose, setae quite long, middle portion of scutellum with fewer setae but these longer than lateral ones. Wing similar to that of ♀ but *Cu* definitely reaching margin; *An* not discernible; length of R_4 relative to R_5, 30 : 73. Claws as in fig. 20, markedly slender, setose basally and laterally; tarsomeres quite thickly setose in contrast to sparsely setose condition in ♀. Genitalia as in fig. 30; in the proportions of the various components of the hypopygium this species is most similar to *kaltenbachi*, different from *starmuhlneri* especially in relatively less elongate dististyles and more elongate tegmen; *microcephala* differs obviously from *kaltenbachi* in having the dististyles constricted near the base.



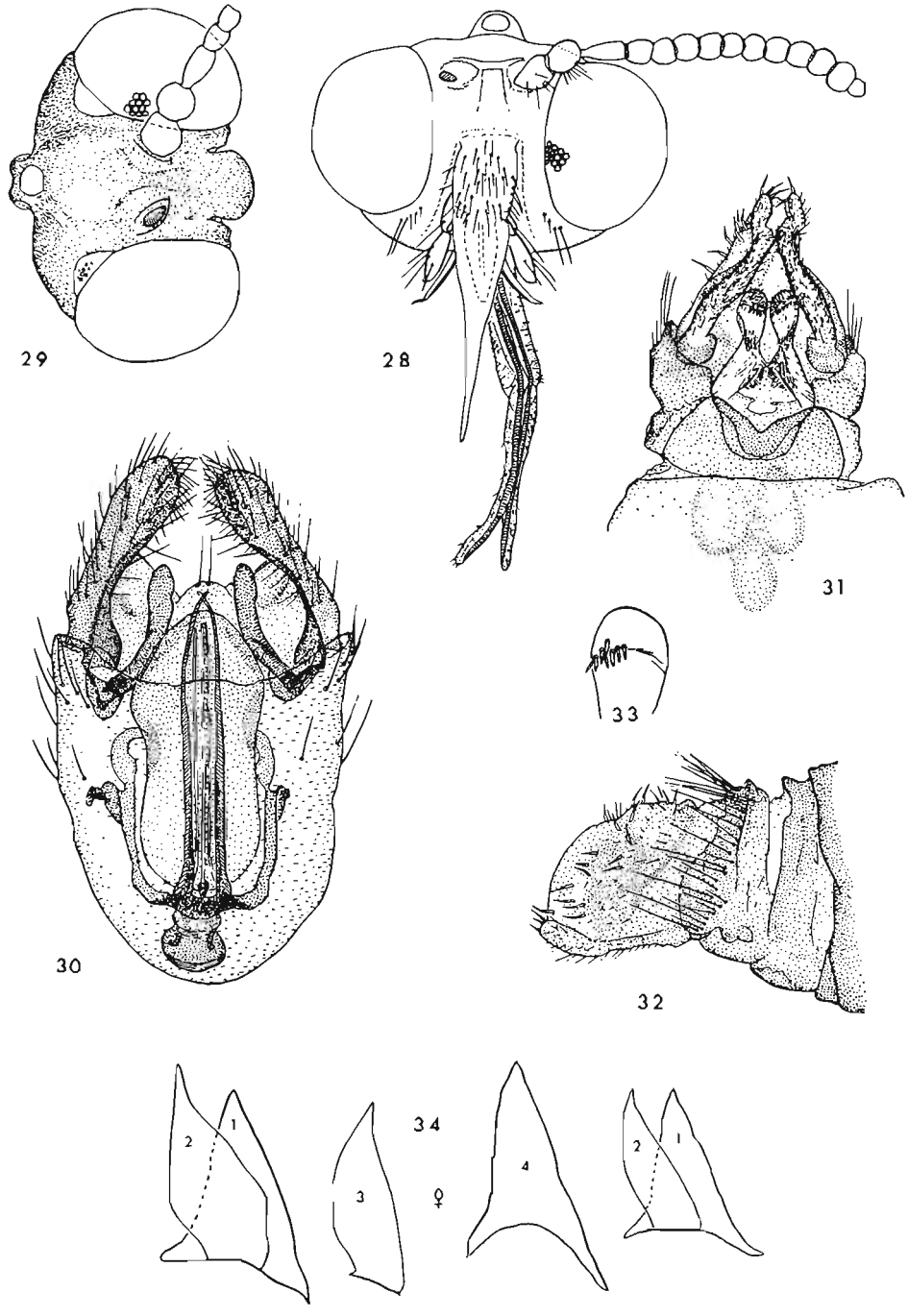
Figs. 24–27. Fourth instar larval pseudopods of (24) *Austrocurupira microcephala* n. sp., (25) *A. starmuhlneri* n. sp., (26) *A. kaltenbachi* n. sp., (27) *Nesocurupira curtirostris* n. sp.

Pupa: Broadly, irregularly ovate, rather flattened; in reflected light showing fine, dark granules evenly scattered over dorsal surface (fig. 37), though more sparingly on 1st and 2nd tergites where they are mainly elliptical instead of subcircular as they are elsewhere; thorax with a few faintly indicated granules, best seen in transmitted light, in reflected light not or hardly apparent; individual granules are somewhat plaque-like, or like dorsally flattened blisters, a high proportion of them with a microstructure on dorsal surface, consisting of a group of minute, blackish dots, apparently elevated points, numbering per granule from one to ten, six about average number (see fig. 40); those granules without this microstructure tend to be grouped together, in places forming quite large areas composed of several dozen granules. Respiratory horns strongly developed, close together, two inner lamellae of each side inclined inwards and touching those of opposite side over midline; lamellae shaped as in fig. 34, very similar to those of *kaltenbachi.*

Length of larvae: 4th instar, 4·4 — 6·3 mm.

Size of pupa: ♂ 4·3 × 2·6 mm; ♀ 5·2 × 3·6 mm.

Material examined: Holotype ♀, ♂, 2 pupae, 6 larvae; New Caledonia, loc. FNK 79/3, 25 August 1965; 'Ouarau-Bach, einer der Quellbäche des Oberlaufes des eingeschinittenes Tal, beim Farmhaus Letocart oberhalb des Dorfes Tchamba. Seehöhe 45 m.'



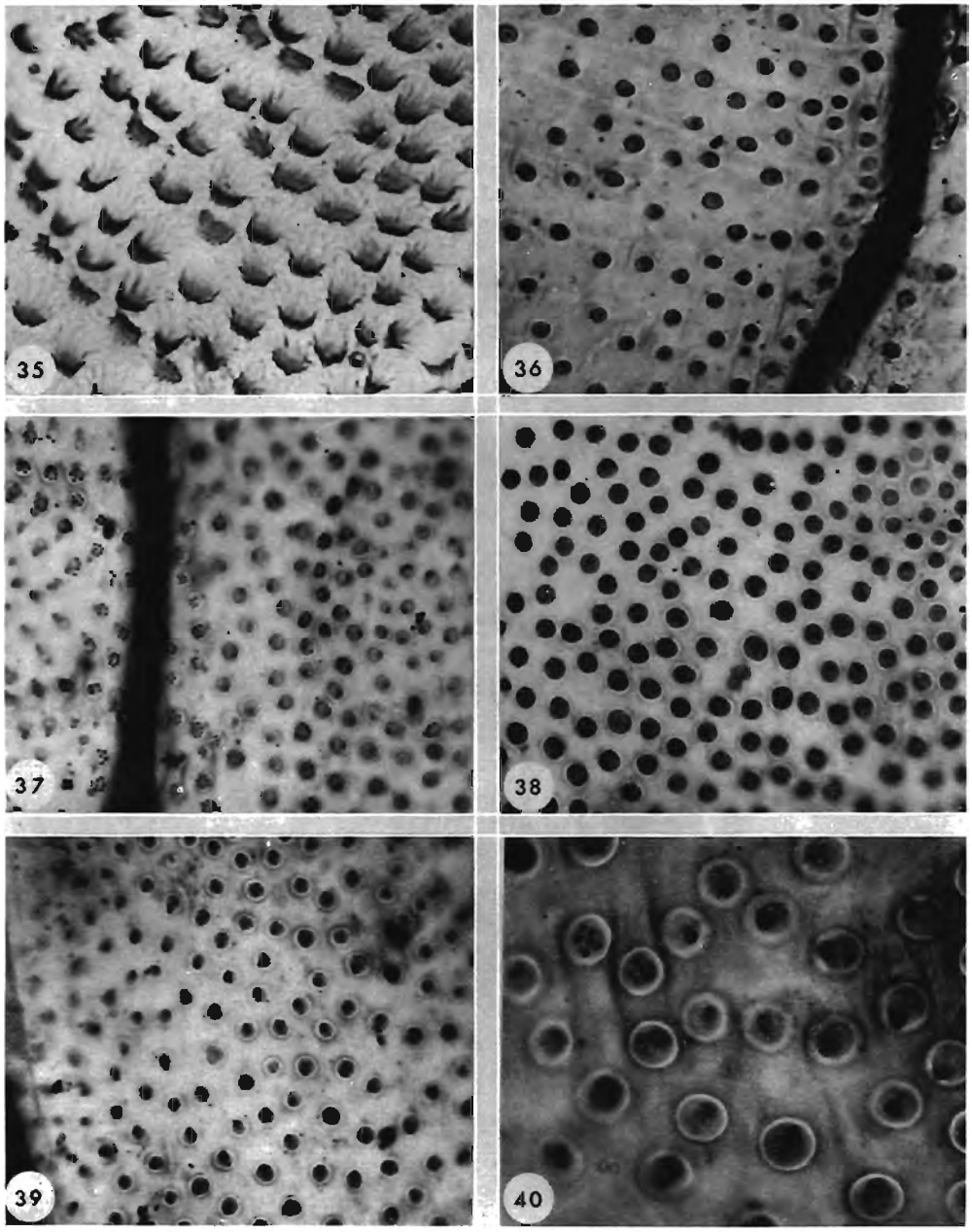
Figs. 28–34. *Austrocurupira microcephala* n. sp.; (28, 29) ♀ head in frontal and dorsal views; (30) ♂ genitalia, ventral; (31, 32) ♀ genitalia, ventral and lateral; (33) inner surface of oviscapt lobe showing group of setae; (34) four respiratory lamellae of ♀ pupa and two (on right) of ♂ pupa, posterior view, anteriormost numbered as 1.

Austrocurupira (Curupirina) starmuhlneri n. sp.

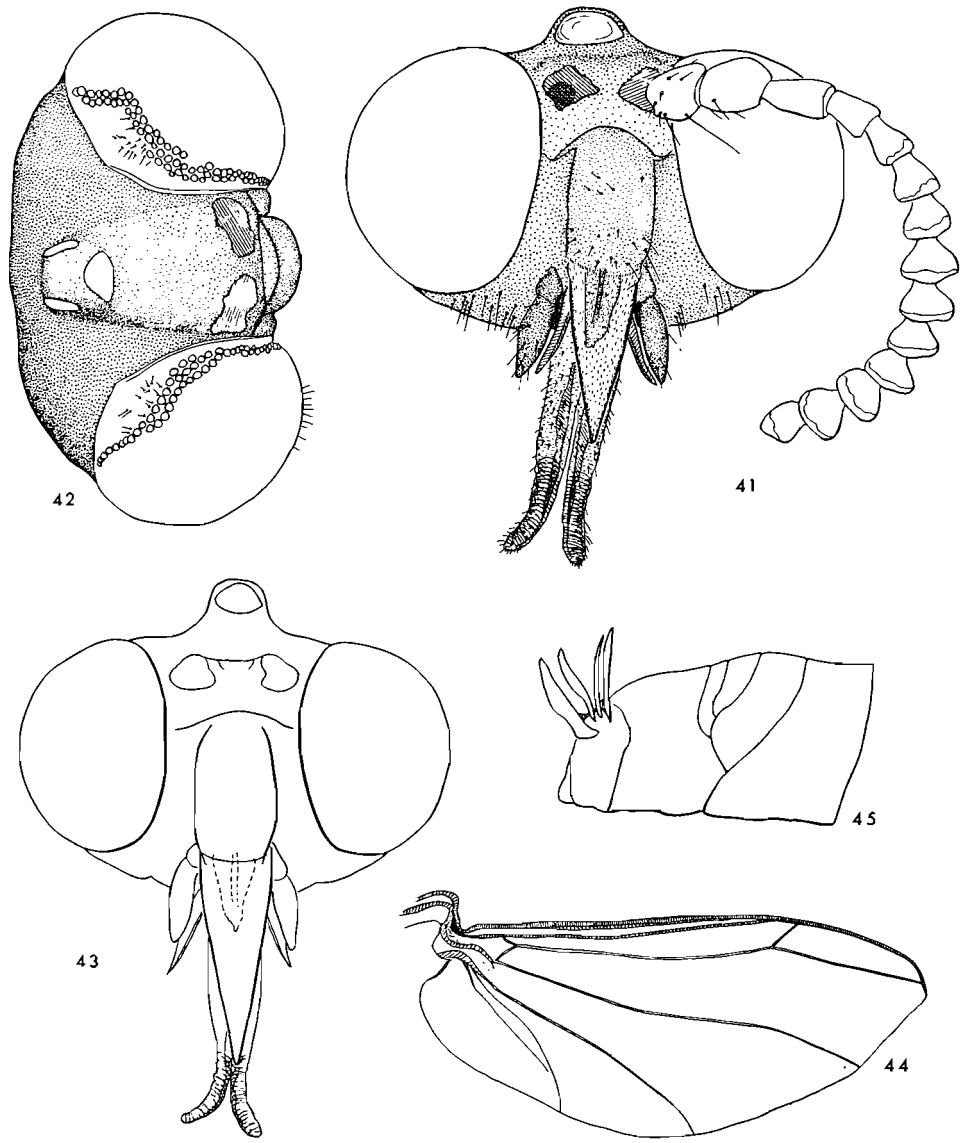
Diagnostic characters: ♂, ♀. Antennae 14-segmented, segments 5–13 modified by the development of an alveolar area around apex of segment; mouthparts reduced, obviously shorter than in two preceding species, labium length a little less than ½ width of head in ♂, a little more than ½ in ♀, not much longer than labrum, especially in ♀; labial palps not divided into basal and distal parts as is usual in blepharocerids, but apparently continuous tubes, not containing pseudotracheae though the sclerotised ridge along the inner margin along which the pseudotrachea normally is attached is still present; apical half or less of palp wall with annular thickening as normally found on distal sections of palp in other species; eye without a definite upper division, though upper corner without facets; microtrichia of wing membrane minute, dot-like, arranged in clusters; ♂ dististyles proportionately longer than in preceding two species. Pupa more obviously granulose than in preceding two species, with granules present on thorax in a group around posterior section of midline; granules not larger than in other species, but stronger and darker which gives them appearance of being larger and closer together; 1st and 2nd tergites abundantly and conspicuously granulose; microstructure on granules present but poorly developed. Fourth instar larva (fig. 6) similar to that of *kaltenbachi* in coloration, thus easily distinguished from larvae of *microcephala* by the dark cephalic sclerites, differing from *kaltenbachi* in having conspicuous, long hairs on pseudopods (fig. 25) and generally fewer spines everywhere.

♂. Head (fig. 41) transverse; eyes evenly covered with fine, short hairs; eyes widely separated, frons almost parallel-sided, a little less than one-third of transverse diameter of head; eye not divided, facets mostly of same size apart from some small ones at margins but upper corner of eye with a small area devoid of facets (fig. 42), this area with some fine hairs like those between facets, and with a few faint, circular areas of much smaller size than normal facets, these apparently vestiges of former facets. Ocellar tubercle prominently raised, anterior ocellus especially large. Antennae 14-segmented, about 1⅓× transverse diameter of head; scape and pedicel with a few setae as shown in figure; first flagellar segment larger than others, broadening a little apically, second flagellar segment shorter but with a more pronounced increase in width apically; flagellar segments 3–11 progressively more irregularly monoliform, this irregularity due to a greater apical swelling on dorsal side than on ventral; apical segment irregularly subovoid, smaller than penultimate one but similarly asymmetrical; change in shape of flagellar segments due to progressive asymmetric development of a sensory alveolate surface composed of small, tightly-packed pits each containing a trichoid sensillum (fig. 4), these sense organs absent in first and second flagellar segments, a few present on third, somewhat more on fourth, thereafter each segment with a large alveolate area which is more extensive on ventral surface; the pits face more or less along or slightly outward of longitudinal axis of antenna.

Labrum elongate-triangular, not slender, as in preceding species, the length only about ⅓ transverse diameter of head; hypopharynx reduced, half labial length, irregularly terminated distally, probably in early stages of regressive evolution, with a narrow median channel visible over most of its length; maxillary palps as figured, small, two-segmented, basal segment asetose, apical segment a little more than thrice length of basal one, subfusiform, some small setae present, no specialised sense organ, entire palp a little less than ¾ labial length; galea projecting as shown, slightly shorter than palp. Labium relatively



Figs. 35–40. (35) *Austrocurupira starmuhlneri* n. sp., flat angular asperities on ventral body surface adjacent to pseudopod of larva; (36–40) sculpturation in dorsal integument of pupa, (36) *Nesocurupira curtirostris* n. sp., (37) *A. microcephala* n. sp., (38) *A. starmuhlneri* n. sp., (39, 40) *A. kaltenbachi* n. sp.; figs. 36–39 to same scale, fig. 40 more highly magnified to show microsculpture on individual plaques.



Figs. 41–45. *Austrocurupira starmuhlneri* n. sp.; (41, 42) ♂ head, frontal and dorsal; (43) ♀ head, frontal; (44) wing from pharate ♀; (45) anterior end of pupa, lateral view.

short, its length less than depth of head (excluding ocellar turret) and a little less than half width of head, half its length extending beyond tip of labrum; no clear division of labial palps into basal and apical portions, and pseudotracheae absent though the longitudinal ridge on inner surface, to which pseudotrachea normally is attached, is present in each palp; wall of a little less than apical half of each palp with annular wrinkling as is found on apical section of palp in species with normal mouthparts, the labium thus presumably in

a state of regressive evolution in this species and apparently functionless (the presence of normal sensilla basiconica on apex of labial palpi suggest that some other function may be served); cibarial pump normally developed.

Mesonotum with a few short setae in irregular dorsocentral rows; scutellum with fairly numerous short setae. Tibial spurs 0.0.1, spur on hind leg a little shorter than diameter of hind basitarsus. Tarsomeres relatively short, quite densely setose, their length in the following proportions (Table 3):

TABLE 3

PROPORTIONATE LENGTH OF TARSOMERES OF A. STARMUHLNERI. ♂ AND ♀ ON DIFFERENT SCALES.

	Basitarsus	2	3	4	5
♂					
Fore-leg	Broken				
Mid-leg	15·5	5·0	4·0	4·0	5·5
Hind-leg	23	8·5	6·5	5·5	7·0
♀					
Fore-leg	34	12	9	8	17
Mid-leg	Broken				
Hind-leg	58	21	17	13	22

Tarsal claws as in fig. 51, without teeth but with fine hairs below and on sides of basal portion. Wing as in fig. 44, *Rs* forked, R_{2+3} much shorter than R_{4+5} (17 : 78); *Cu* apparently attaining margin, *An* not reaching margin, in mount of pharate wing its end approaching *Cu* very closely though this may be an artifact to some degree; R_1 setose, setal bases mostly not separated by more than a setal length from each other; microtrichia of membrane minute, dot-like, mostly arranged in small clusters; anal lobe shaped as figured.

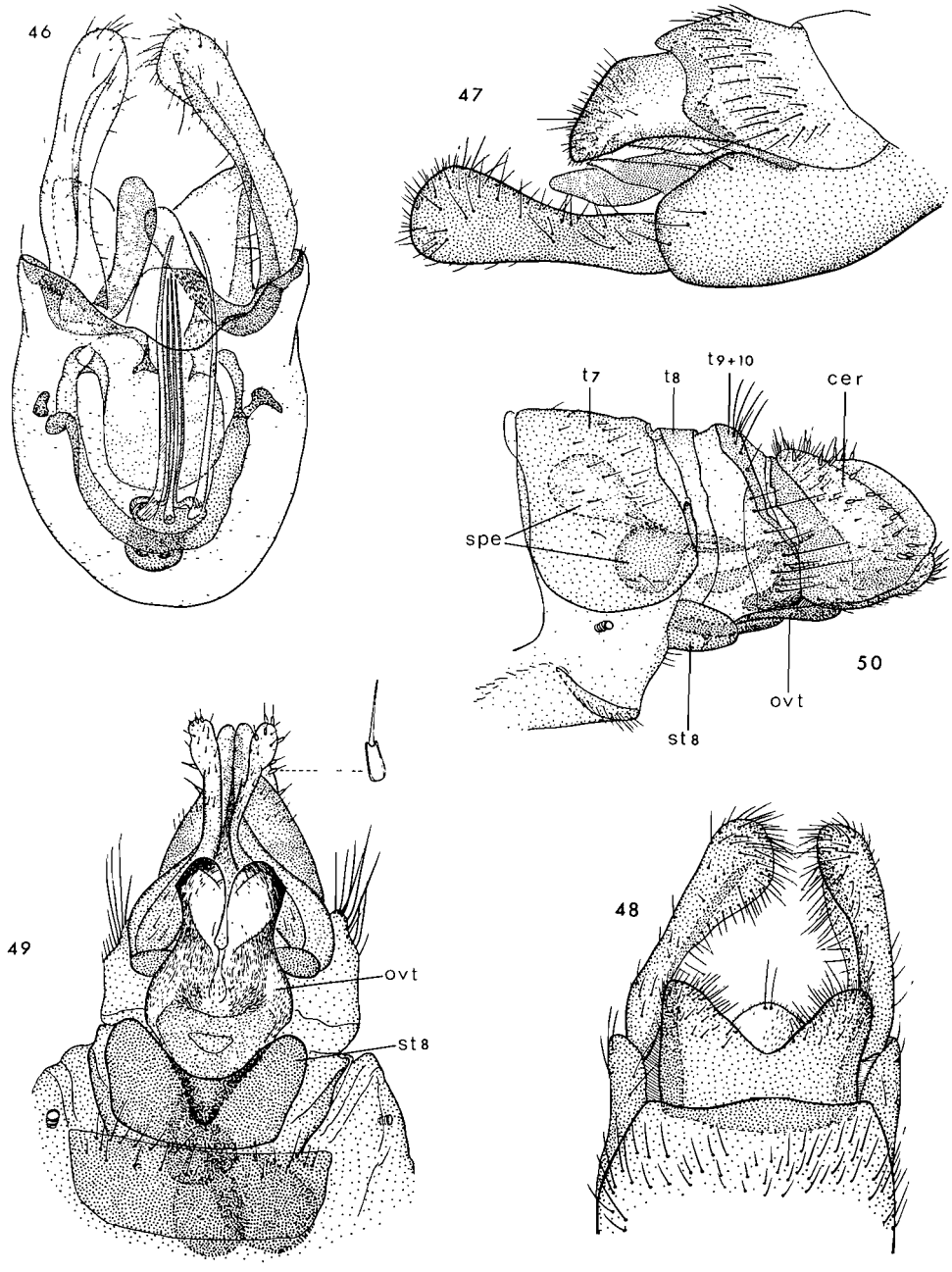
Hypopygium as in figs. 46–48; cerci as figured, fused as usual; dististyles relatively long, broadened apically; tegmen relatively short in comparison with preceding species.

♀. Shape of head, nature of frons, antennae and eyes very much as in ♂, virtually no sexual dimorphism in respect of these features; labrum relatively larger than in ♂, its tip attaining proximal end of annulated apical part of labial palpi; hypopharynx much reduced, only about $\frac{1}{3}$ of labial length, with a midline channel, apex of irregular shape. Ocellar tubercle even more prominent than in ♂. Tarsal claws (fig. 51) stouter and more strongly curved apically than those of ♂. Genitalia (figs. 49, 50) characterised by shape of oviscapt and presence of only a few (8–9) blade-like setae on upper surface of each lobe.

Pupa: In shape (figs. 45, 52) generally similar to other species, but appearing much more obviously and strongly granulose on upper surface (fig. 38), also with a group of strong granules on thorax around midline near posterior end; 1st and 2nd tergites with numerous, strong granules like those elsewhere; granules slightly larger and closer together than in other species, this appearance enhanced by their heavier sclerotisation and darker colour; many have a microstructure similar to that of preceding species, but this weakly developed, apparent only as exceedingly small, refractive dots.

Size of pupa: 4·5 × 2·5 mm.

Length of larvae: 4th instar, 4·8 — 5·4 mm; 3rd instar, 2·4 — 3·8 mm; 2nd instar, 1·2 — 1·9 mm.



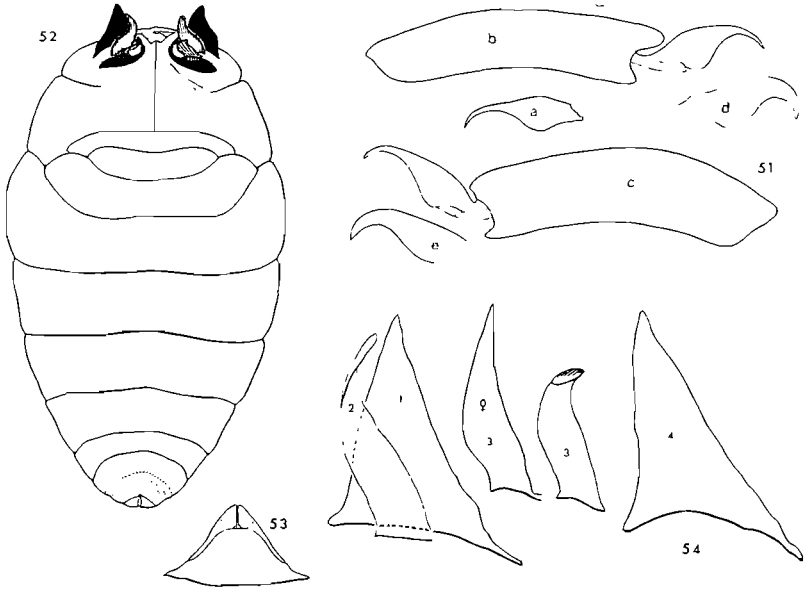
Figs. 46–50. *Austrocurupira starmuhlneri* n. sp. Genitalia; (46) ♂, ventral; (47) ♂, lateral; (48) ♂, dorsal; (49) ♀, ventral, inset on right a modified seta from cercus, on left inner surface of apex of oviscapt lobe showing group of setae; (50) ♀, lateral. Abbreviations: *cer* = cercus, *ovt* = oviscapt, *spe* = spermatheca, *st* = sternite, *t* = tergite.

Material examined: Holotype ♂, ♀, pupae, larvae; New Caledonia, loc. FNK 58/2, 5 August 1965; 'Rivière du Thir (od. Thy), bei der Einmündung des Bächleins von FNK 56, Urwald, beschattet. Seehöhe knapp unter 100 m (FNK 56; Quelle und Quellbach im Vallée du Thir, Zufluss des R. du Thir im Garten der ersten Villenhauses . . .).' Numerous larvae, FNK 59/2, same date; as above, but 'Kaskaden wechseln mit lenitischen Abschnitten. Seehöhe 120 mm.'

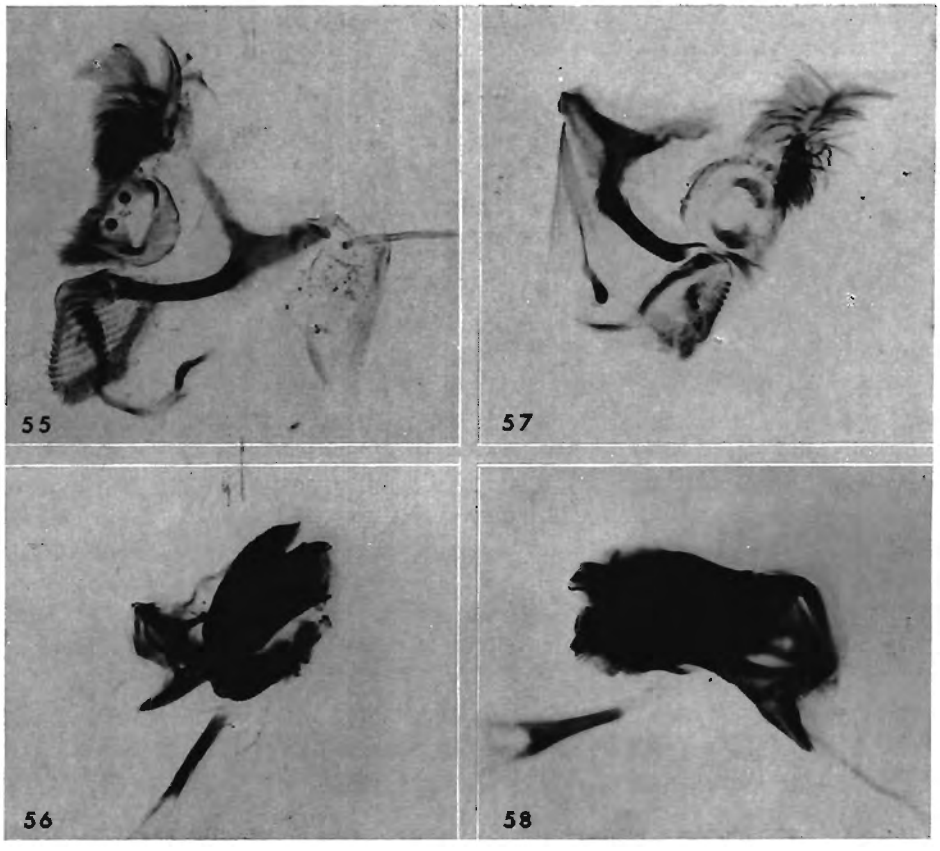
Genus **Nesocurupira** n. gen.

Imago: Only the ♀ known; mouthparts very greatly reduced, rudimentary, labium represented by minute, unsegmented lobes, maxillae reduced to very small, unsegmented protuberances bearing a vestigial galea, labrum a short, blunt lobe; antennae nine-segmented; eyes widely separated, undivided, tibial spurs absent; *Rs* unbranched, R_{2+3} absent.

Larva: Pseudopods of characteristic form, strongly tapered distad over basal half, slightly swollen over much narrower apical part, appearing constricted in middle; median divisions with a narrow transverse ridge on anterior margin, this narrowly interrupted in midline, a strong spine present on either one of the two inner ends, this spine invariably present on each median division in second and third instars, irregularly present and smaller in 4th instar (apparently missing through accidental damage in many cases); anal division completely fused to fifth median division; seventh pseudopod vestigial, represented by slight tubercle bearing a long, curved seta; fifth median division broader than anal division, no marginal



Figs. 51–54. *Austrocurupira starmuhlneri* n. sp.; (51) claws, *a–c* of ♂, *d–e* of ♀, *a* of fore leg, *b* and *d* of middle leg, *c* and *e* of hind leg; (52) pupa; (53) cephalic sclerite of pupa; (54) right respiratory lamellae, posterior view, from ♂ pupa except left no. 3, anteriormost lamella numbered as 1.



Figs. 55–58. Fourth instar larval maxilla and mandible of (55, 56) *Austrocurupira kaltenbachi* n. sp.; (57, 58) *A. starmuhlneri* n. sp.

constriction between them or only a slight one, sides of anal division subparallel. Antennae two-segmented in second to fourth instars, in final instar apical segment only slightly longer than basal one. Gill filaments as in *Austrocurupira*, five in each tuft in fourth instar. Maxillary palpal broom sclerite with an aborally directed lobe; teeth on lacinial pad in only 6–7 rows.

Pupa: Distinguished by extreme narrowness and weakness of two inner respiratory lamellae, and wide spacing of very distinct granules in dorsal surface and their presence on thorax.

Type species, *Nesocurupira curtirostris* n. sp., described below.

The generic name is considered to be feminine.

Nesocurupira curtirostris n. sp.

Diagnostic characters: Easily distinguished from other New Caledonia blepharocerids by the unbranched *Rs*, vestigial mouthparts, lack of tibial spurs and a multitude of details in the conformation of the tarsal segments oviscapt and antennae; the larvae are easily

distinguished from those of *Curupirina* by the shape of the pseudopods and lack of spines on them (fig. 27), median interruption of the anterior transverse ridge of the median divisions, and (especially in second and third instars) the presence of one strong, black, erect spine adjacent to midline on each median division; pupa distinguished by generic characters cited above.

♀. Head (fig. 59) transverse; eyes widely separated, frons narrowing a little anteriorly, interocular space just above clypeus $\frac{1}{3}$ of transverse diameter of head; eyes undivided, no area of reduced facets above, with usual fine hairs, facets relatively thick-walled. Integument surrounding antennae and in a strip before ocellar tubercle, paler and a little weaker than elsewhere, resulting in a pattern as shown in fig. 60, deeply biconcave piece between antennae quite noticeable. Ocellar tubercle a moderately elevated mound. Antennae 9-segmented, division between first and second flagellar segments not as definite as that between other segments; segments shaped as in fig. 59, scape and pedicel a little thicker than others, flagellar segments 3–5 clearly swollen on lower surface; apical segment obviously shorter than preapical; minute sensory pits irregularly scattered on flagellar segments, no alveolar surface developed as in *starmuhlneri*; length of antenna relative to width of head 141/100, i.e. about 1·4× width of head. Mouthparts remarkable for very great reduction (figs. 59, 61); labrum reduced to a somewhat irregular, subtruncate lobe about as broad in middle as long, narrowing slightly apicad, in length only about $\frac{1}{5}$ width of head, its anterior surface evenly covered with minute setulae, on its posterior surface a number of conspicuous sense organs of two sizes, the larger distributed medially; labium reduced to a vestigial structure considerably shorter than labrum behind which it is completely concealed, consisting of two rather flat lobes of somewhat irregular shape, finely setulose over much of outer surface, these lobes attached to a more strongly sclerotised, transverse, basal section which has a fairly broad, short, median groove; maxillary palpi reduced to stout little protuberances, apparently one-segmented, finely setulose, with a few conspicuous sense organs at apex; galea reduced to a squat, subtriangular lobe projecting from palpi, as shown in fig. 61. Sclerotised portions of cibarial pump well developed.

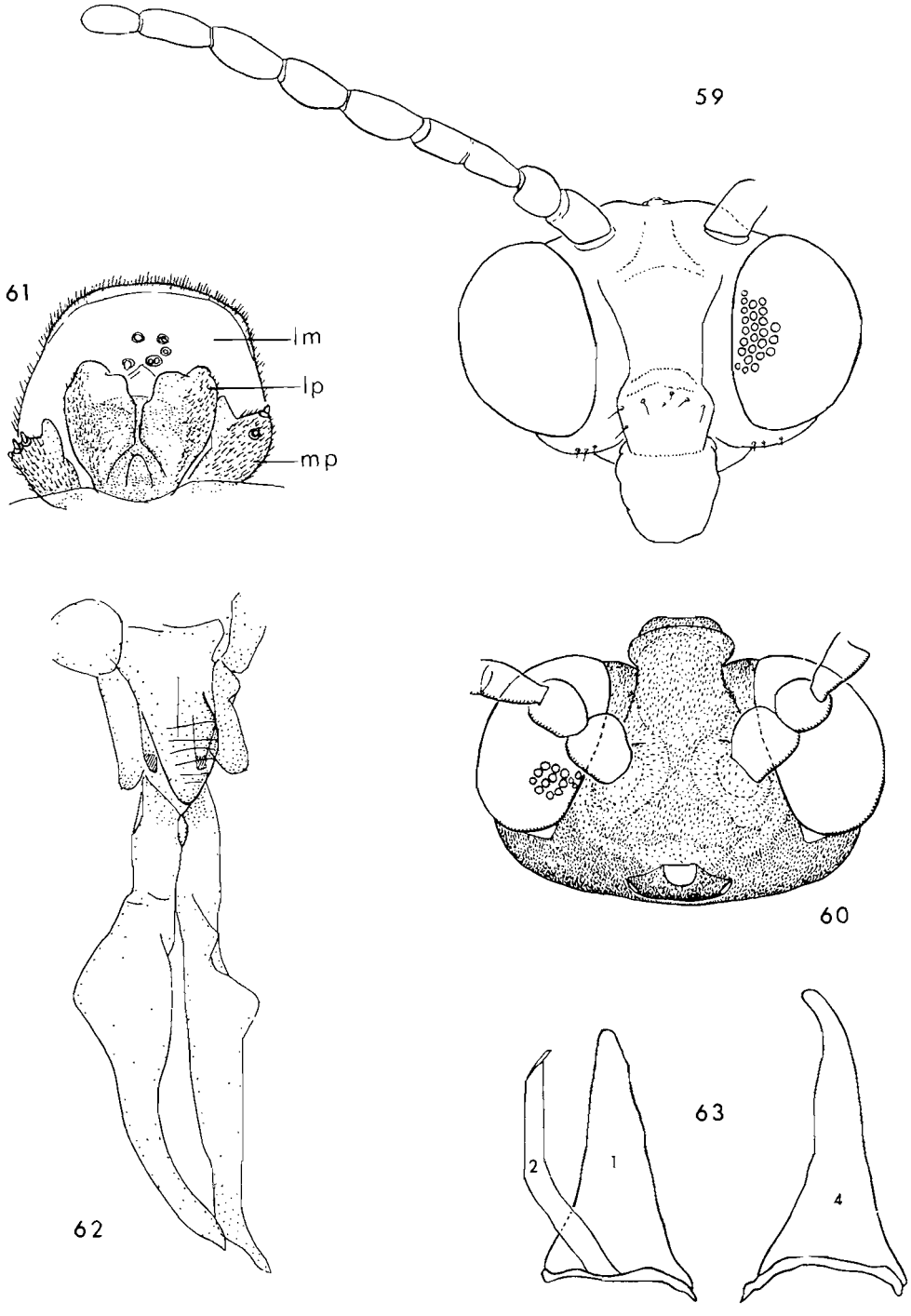
Mesonotum without setae. Scutellum with a transverse row of setae asymmetrically interrupted medially. Legs (figs. 67–69) noteworthy for several features; tarsi unusually elongate, slender, especially on first leg which has a stout femur; relative length of tarsomeres as in Table 4:

TABLE 4

PROPORTIONATE LENGTH OF TARSOMERES IN N. CURTIROSTRIS

	Basitarsus	2	3	4	5
♀					
Fore-leg	70	32	26	22	55
Mid-leg	40	22	16	16	50
Hind-leg	57	36	26	25	58

Joints between tarsomeres very obliquely angled, quite different to the type found in *Austrocurupira* species; their direction of slope, forming an acute angle with ventral surface, indicates the tarsi have unusual flexibility in dorsal plane and very little in ventral plane as basal 'heel' on ventral surface seats in trough-like apex of projecting lower edge of preceding tarsomere. Tibial spurs absent. Vestiture also unusual in several respects; setae longer and finer than in *Austrocurupira* species, present mainly on dorsal surface of femur and tibia,



Figs. 59–63. *Nesocurupira curtirostris* n. sp.; holotype ♀, (59) head, frontal and (60) dorsal; (61) mouthparts, posterior; (62) pupal sheath of mouthparts; (63) right respiratory lamellae, posterior view, anteriormost numbered as 1.

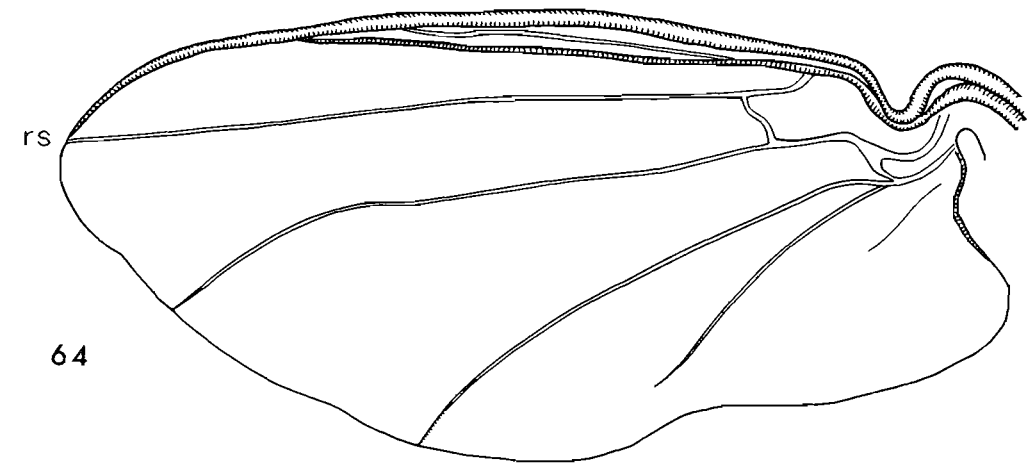
sparsely scattered on posterior surface, setae absent on anterior and ventral surfaces; tarsomeres almost devoid of long setae except in narrow dorsal strip; elsewhere there are sense organs (which are progressively more numerous per tarsomere towards apex of tarsus) in form of very fine trichoid sensilla. Claws as in figs. 67–69, without teeth or hairs below.

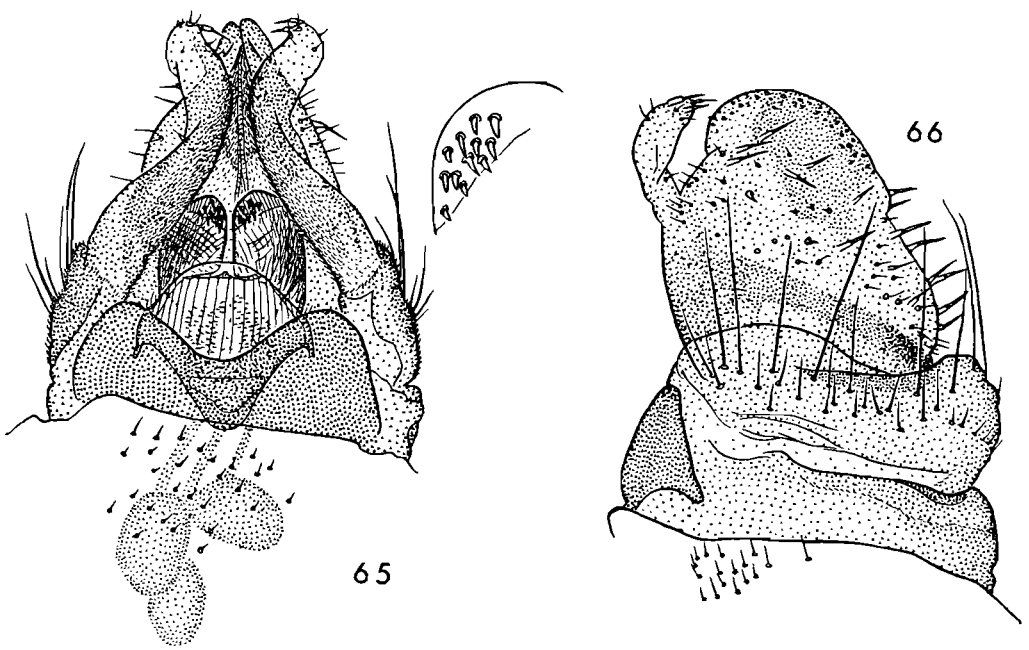
Wings as in fig. 64; *Rs* unbranched, thus only two radial veins present; *An* not apparent in either stained or unstained wing, possibly absent; *Cu* not attaining wing margin. Microtrichia of membrane minute, in places showing a somewhat indefinite tendency to arrangement in groups. Wing rather deep, with somewhat projecting anal lobe. R_1 setose except over a short apical section, setal bases usually separated by about a seta length from each other.

Genitalia (figs. 65, 66) characterised by shortness of oviscapt; 12 blade-like setae in group on dorsal surface close to posterior end; cerci with thumb-like projection from ventro-apical surface.

4th instar larva: Body form as in fig. 75, unremarkable; in general shape somewhat elongate and narrow, in dorsal view profile not suggestive of an elongate ellipse as in *Curupirina*; cephalic division subcordiform; cephalic sclerites normally formed, incisions in lateralia deep and narrow, not attaining antennal fovea, frons relatively elongate, length about $5\frac{1}{2}\times$ width at midlength, dorsal ecdysial lines uniting at anterior end of frons and not thereafter continuing forward as a median fronto-clypial ecdysial seam; clypeus with sharp anterior rim; head capsule descending forwards quite steeply. Mouthparts as figured; mandible (fig. 72) bilobed, cutting edge of outer lobe with a few deep, narrow incisions giving an irregular, sparsely serrated appearance, mandibular abductor apodeme slender, rod-like, contrasting with much wider, stronger adductor apodeme; mandibular prostheca present, a tuft of microtrichia on adoral surface; maxillae as in figs. 70, 71, lacinial area rather small, armed with pectinate teeth, like curved combs, set in about six or seven rows; sensory disc at basal end of a subrectangular plate, this plate bearing adjacent to its aboral edge a number of sense organs which increase in size and concentration towards apex close to which is a prominent group of them of which one is much larger than the others; reflexed aborally at 90° to this plate on its apex is a short, much narrower, apically rounded lobe bearing apically some microsetae, fringed on its distal edge with much shorter, unbranched microsetae constituting a rather sparse palpal broom which continues in a fringe around adoral edge of subrectangular sclerite to sensory disc (fig. 71). Antenna two-segmented, segments almost equal in length, apical one slightly larger and a little more slender than basal. Constrictions between body divisions relatively deep and narrow. Anal division and fifth median division fused, no angular constriction between them as in *Curupirina*, but fusion not as complete as in *Austrocurupira* s. str.; lateral margins of anal division subparallel, this division not as wide as fifth median one which projects laterally beyond these margins. Each of first four median divisions with a transverse, well sclerotised, rather narrow, raised, rounded strip along anterior border of upper surface, stopping laterally quite abruptly about midway between lateral corner of division and edge of anterior collar-like portion; this ridge not complete but narrowly interrupted in midline; along hind margin of these divisions a less prominent strip borders hind margin of dorsal surface, this strip not interrupted medially, not extending laterally as far as anterior one,

curved to follow posteriorly concave shape of division. Cephalic division with comparable strip along hind margin, anterior ridge of median divisions represented just behind head capsule where there are two straight, quite broad swellings in the integument set at a small angle to one another to form a shallow chevron concave anteriorly. On fifth median division anterior ridge present, as on others, but posterior one absent owing to fusion with anal





Figs. 64–66. *Nesocurupira curtirostris* n. sp.; holotype ♀, (64) wing from pharate specimen, *rs* = radial sector; (65, 66) ♀ genitalia in ventral and lateral views, inset inner surface of apex of oviscapt lobe showing group of setae.

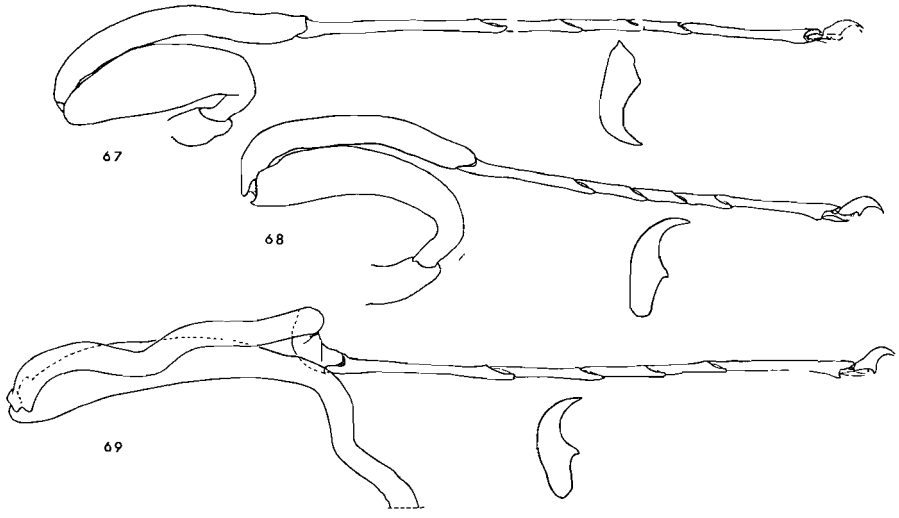
division. Five gills in each tuft, three directed anteriorly, two posteriorly, subequal except for inner posterior one which as usual is longer. Pseudopods (fig. 27) of characteristic shape, appearing to be strongly constricted near middle, basal section tapering quite strongly, apical section narrower than basal but with a slight swelling. Seventh pair of pseudopods vestigial, represented only by a slight tumidity from which arises a strong curved seta. Pseudopods without spines, but bearing a dense tuft of hairs on upper surface. Vestiture of cephalic division composed of setae only except for a few minute spines posterior to pseudopod; each median division with a single spine dorsally, placed on either right or left inner end of anterior transverse strip, placement apparently quite irregular and often different on adjacent divisions, these spines irregularly absent but where so always a socket present indicating the absence to be probably accidental; spines blackish, in this instar metrically smaller than in earlier instars, usually shorter than antennal length, sometimes very short. Vestiture of median and anal divisions consisting only of minute lateral spines before and behind pseudopods. No roughened surface bordering hind margin of anal division.

Coloration unremarkable; dorsum dull brownish slightly yellow-tinged; anterior transverse ridges blackish-brown; posterior strip darker brown than adjacent integument; cephalic sclerites blackish-brown; antennae blackish; collar-like posterior part of first median division contrasting creamy whitish, this part similarly coloured, though progressively more narrowly so towards hind end of body, on other divisions in larvae about to pupate; pseudopods dark brown to blackish-brown above, contrasting with pale amber hairs, ventral surface paler, translucent creamy-brown up to constriction where a narrow transverse strip of dark brown separates off apical 'sole'; underside of larva dull whitish. Length 3·1 — 4·7 mm.

3rd instar larva: Median divisions with strong spines in midline which are a little longer than antennal length and rather abruptly narrowed over apical half or a little less; antennae two-segmented, apical segment twice length of basal one; three gill filaments in each tuft, two directed anteriorly, one posteriorly; pseudopods relatively more elongate than in last instar; coloration in general paler than in fourth instar, dorsal surface pale brownish with slight dull yellow tinge. Length 2·5 — 3·0 mm.

2nd instar larva: Spines on median divisions large and prominent, almost as long as body is deep; a single gill filament present on each side, directed anteriorly; anal and fifth posterior divisions completely fused, latter not projecting laterally beyond margins of anal division; antennae two-segmented, basal segment very slightly longer than half apical segment. Length 1·7 mm.

Pupa: Of the usual shape, moderately deep, respiratory horns placed well forward on strongly descending anterior surface, arising from a moderate elevation; respiratory lamellae as in fig. 63, anterior and posterior lamellae elongate subtriangular, posterior one a little longer, more slender and irregular than anterior, inclined a little towards midline, these two lamellae dark brown, strongly sclerotised; second and third lamellae quite different in shape, very narrow, translucent, weakly sclerotised (bent or otherwise damaged in available specimens), irregularly pointed apically; the two outer lamellae curve at their outer basal ends almost to meet, thereby enclosing an area out of which inner two arise. Integument brown, conspicuously granulose on all abdominal tergites and in a small patch on thorax around



Figs. 67–69. *Nesocurupira curtirostris* n. sp. Legs and claws; (67) fore leg; (68) middle leg; (69) hind leg.

hind part of median line; granules (fig. 36) well defined but widely spaced in comparison with *Austrocurupira* species; in shape each granule a dorsally flattened blister; nearly all granules have a dark central mark apparently due to presence of an internal duct leading to inner surface of pupal integument.

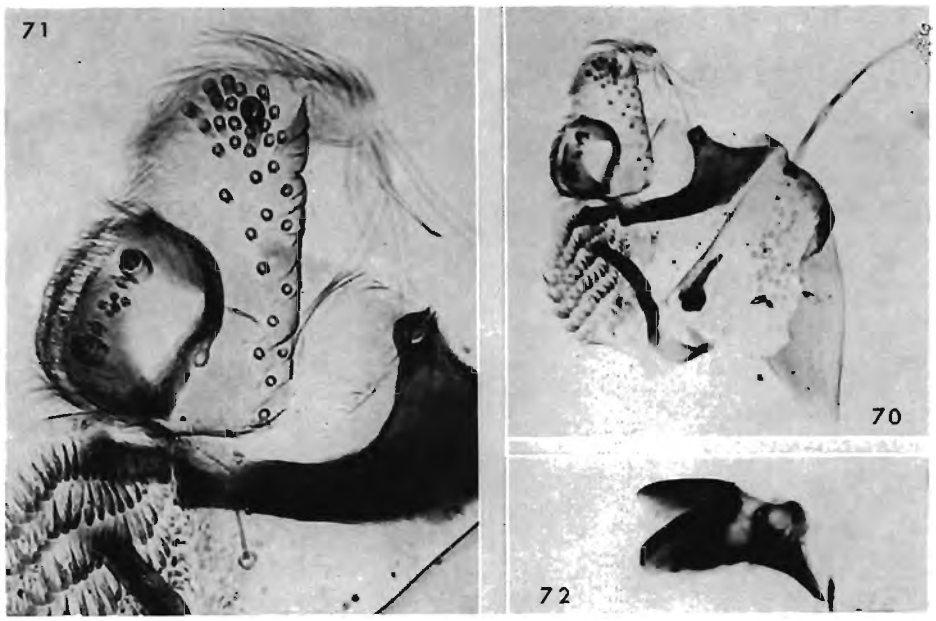
Size: 3·6 × 1·9 mm.

Material examined: Holotype ♀, 2 pupae, 3 larvae; New Caledonia, loc. FNK 74, 18 August 1965; 'Unterlauf des Petit oder Fausse Yaté, der S. von Yaté in die Baie de Yaté mündet, 150 m vor der Mundung, der Sammelort steht im obersten Bereich des Flutrückstaues, nicht beschattet. Seehohe 4 m.' Larvae, loc. FNK 13, 16 July 1965; 'Branche Sud des Dumbéa-Flusses, 3 Km nach dem Stausee, nicht beschattet. Seehöhe 100 m.'

Subfamily ? *PALTOSTOMINAE*

Genus et species incertae sedis

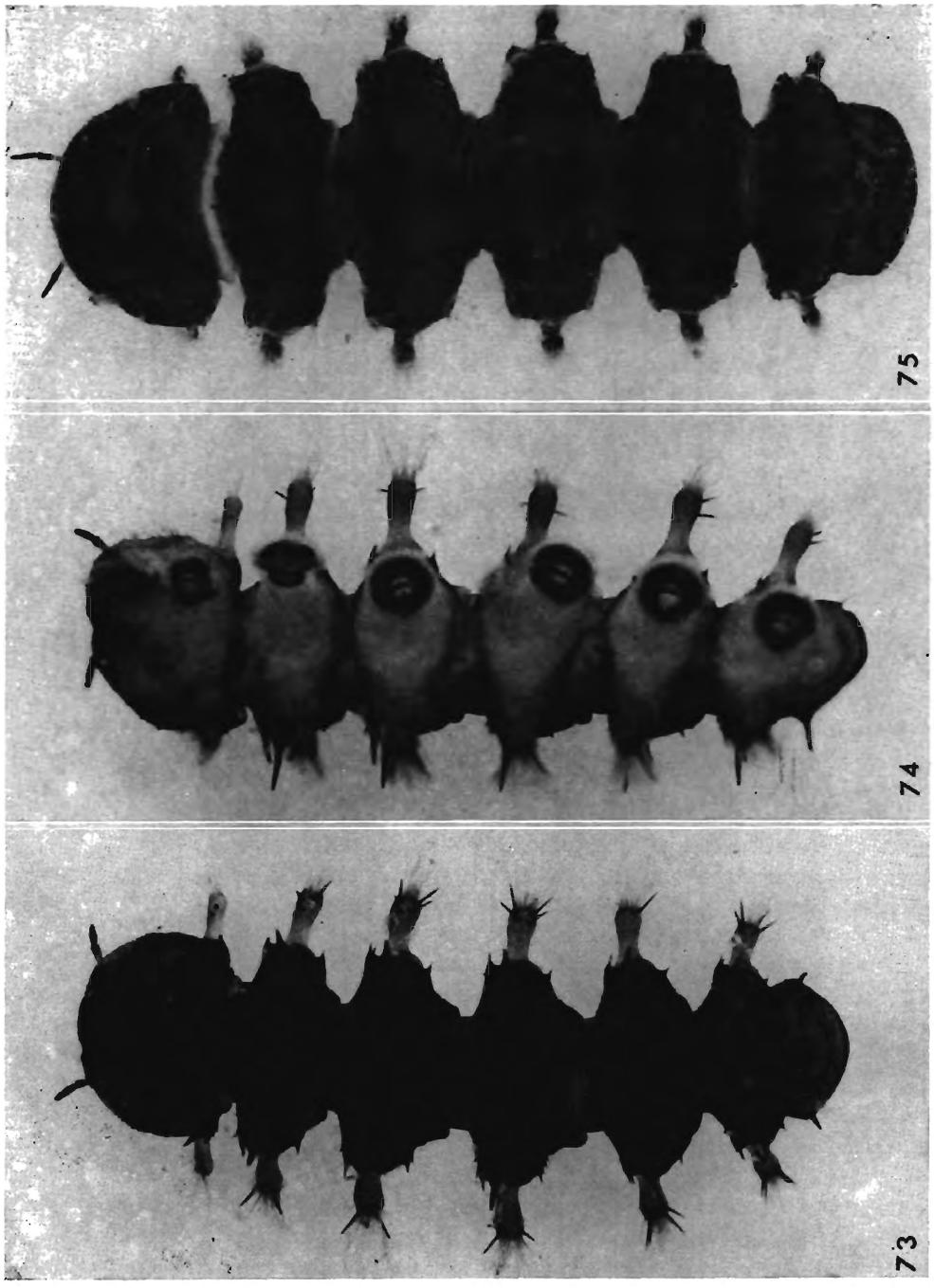
4th instar larva: (figs. 73/74) length 3·6 mm with five gill filaments in each tuft, apparently recently moulted. Cephalic division relatively broad, its widest part not near posterior margin but shortly behind middle, in front descending steeply for a considerable distance, head capsule unusually deep dorso-ventrally; sclerotisation of capsule relatively extensive, incisions in lateralia narrow, not attaining antennal fovea, a large, conspicuous ocellus contained in anterior end; clypeus descending almost vertically, broad and deep, slightly swollen; a transverse, roughly chevron-shaped impression across capsule between antennal foveae, causing a concavity in middle part of anterior edge of profile of capsule in dorsal view, clypeus protruding beyond this concavity; peristomal ridges more darkly sclerotised than surrounding integument, quite conspicuous; antennae two-segmented, segments subequal, basal one widened apically a little, apical segment narrowed over distal half, its



Figs. 70–72. Fourth instar larval mouthparts of *Nesocurupira curtirostris* n. sp.; (70) maxilla; (71) palpal broom sclerite, further enlarged; (72) mandible.

greatest width near middle. Mandibles (fig. 15) bilobed, outer lobe with a deep, narrow cleft in apical margin, cutting edge of inner lobe deeply serrate, there being six strong teeth. Maxilla (fig. 14) with relatively small lacinial pad, but this with large teeth which are curved and strongly pectinate, arranged in six rows, basal margin of pad fringed with fine setae; entire adoral edge of sensory disc sclerite fringed with hairs; palpal broom lobe simple, its sense organs in basal group, broom dense and extensive. Dorsal surface of cephalic division with two deep, roughly transverse depressions about in line with pseudopods, in each depression an elongate muscle-scar, just about inner end of this scar a small, subovoid mark paler than surrounding integument.

Constrictions between divisions deep and wide, median divisions 1–4 with well-developed collar-like anterior and posterior portions; anterior and posterior margins of lateral parts of median divisions not ridged. Fifth median division comparatively smaller than others, broadly attached to anal division, separated by a moderate constriction in lateral margins. Anal division without signs of segmentation, its hind margin curved, with a fairly sharp rim. Pseudopods rather elongate subcylindrical, those of median divisions with a slight median constriction, a clearly defined 'sole' ventrally over apical third; pseudopods on anal division represented by small tubercle bearing a strong, curved seta (on left side this seta is doubled, probably an abnormality). Five gill filaments in each tuft, three directed anteriorly (of which innermost is longest), two directed posteriorly (of which inner one is longest of five). Bordering anterior dorsal and posterior basal margins of pseudopods is a fold of integument more weakly sclerotised than that of dorsal surface of body, lying between pseudopod edge (which it slightly overlaps) and lateral margin of dorsal surface.



Figs. 73–75. Fourth instar larva of (73, 74) undetermined genus and species from New Caledonia, (75) *Nesocurupira curtirostris* n. sp.

Dorsal surface bearing conspicuous, erect, strong, black spines; cephalic division spines only half as strong as those on first median division, comprising one behind inner end of each transverse depression and another, smaller one on upper side of postero-lateral corner. Each median division with four subequal, powerful spines, two paramedian ones arising from transversely elongate tubercles which bear also a few small spines outward of large inner one, and lateral spines on subconical tubercles above insertion of pseudopods; these spines measure about 0·25 mm, about equal to length of median division pseudopod (which is relatively elongate in this species) or $1\frac{1}{4}\times$ length of antenna. Anal divisions with a strong spine on subconical tubercle on each lateral angle. Small, dark spines on antero-lateral and postero-lateral edges of median divisions, postero-dorsal to pseudopods on cephalic division, and on antero-dorsal surface of median divisions (irregularly developed in number and size). Each median division in addition has four small spines placed on a narrow, transverse swelling of the integument forming anterior margin to posterior collar-like section of division, inner two of these spines closer to each other than either is to lateral one; cephalic division with four comparable small spines on a similar transverse strip of integument at hind edge; anal division without such a strip though with four equivalent small spines, inner two close together, outer two on a more anterior plane. Pseudopods with conspicuous, quite slender but strong, dark spines on upper surface, these irregularly variable in number; cephalic division pseudopods have two spines arranged proximally and distally, pseudopods of other divisions have spines placed antero- and postero-dorsally, one pseudopod with one spine, two with two spines, two with three spines, remainder four-spined. Pseudopods also have tufts of long hairs dorsally and apico-dorsally, these hairs longer than spines. Anterior margin of clypeus with two downwardly-directed bristles, a long seta in anterior corner of cardo area; cephalic division ventrally with usual three bristles on each side in longitudinal rows, some setae of various lengths ventro-laterally, and some small, peg-like spines laterally and latero-dorsally. Hind margin of anal division asetose, but on ventral surface close to rim a row of small but strong, downwardly directed setae.

Colour dorsally dull brown obscurely yellow-tinged; pseudopods paler, clear pale yellowish-brown with contrasting dark spines and pale amber hairs, soles pale orange-brown; basal antennal segment brownish, apical segment dark brown; tubercles bearing spines are blackish-brown.

Material examined: Fourth instar larva; New Caledonia, loc. FNK 97, 7 September 1965; collected among specimens of *Austrocurupira kaltenbachi*, details of locality as given in description of that species.

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